JOURNAL OF GAS LIGHTING AND WATER SUPPLY

VOL. CXXXIV. No. 2771.] LONDON, JUNE 20, 1916. [68TH YEAR. PRICE 6d.

O'NEILL'S

OXIDE

GAS PURIFICATION & CHEMICAL CO., Ltd.

PALMERSTON HOUSE, LONDON, E.C.

Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 LONDON WALL.

TORBAY STOVE BLACK FOR GAS COOKERS.

The TORBAY PAINT CO.,
26, 27, & 28, Billiter St., London, E.C.
39-41, Old Hall St., Liverpool.

PUMPING ENGINES
All Types for ACID, &c.

CAST-IRON OR STEEL TANKS
Any Capacity.

CHEMICAL PLANT.

Roofs and Girders. Structural Work.

SULPHATE OF AMMONIA PLANT

Air and Gas Compressors.

MIXERS.

TAR STILLS AND CONDENSERS.

W. NEILL & SON, LD.
Engineers, Iron & Brass Founders,
ST. HELENS JUNCTION.
Telegrams: 'NEILL, ST. HELENS.' Telephone No. 20.

THE UNITED
FLEXIBLE METALLIC TUBING CO., LTD.
FOR GAS, OILS & HIGHEST STEAM PRESSURES
112, QUEEN VICTORIA ST E.C.
Works: PONDERS END, MIDDLESEX.

BROWNOX-DE-LUXE
and
BROWNOX
British Purifying Material
Of Proved Efficiency.

SPENT OXIDE PURCHASED
Exchange or Loan Terms Arranged.

J. BROWN & CO., Ltd.
Savile Town, DEWSBURY.

Makers of
GASHOLDERS,
TANKS (C.I. or Steel),
PURIFIERS,
WASHERS,
ROOFS,
&c.

ASHMORE, BENSON, PEASE & CO., LTD.
STOCKTON-ON-TEES.

Complete GAS WORKS

London Office:
39, Victoria Street, Westminster, S.W.
Telegrams: "GASHOLDER."

JAMES McKELVIE & CO.
Coal Owners,
Cannel and Gas Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
Telegrams: "MACKELVIE, FEN, LONDON."
Telephone: AVENUE 2177.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
VICTORIA BUILDINGS, BUTE DOCKS, CARDIFF.

Prices and Analyses of all the Principal Cannel, Gas, and Steam Coals forwarded on application.

ESTABLISHED 1840.

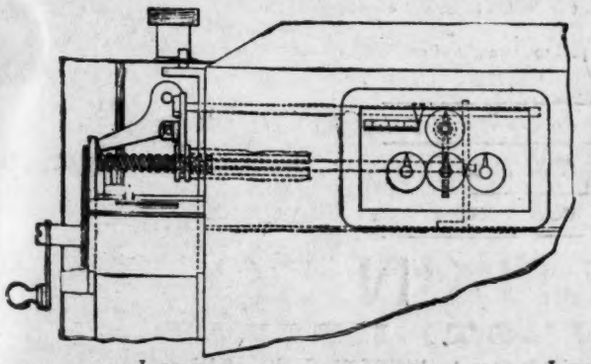
W. & B. COWAN
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),

LONDON. MANCHESTER. EDINBURGH. GLASGOW.
SYDNEY. MELBOURNE. BRISBANE. WELLINGTON, N.Z.

(See Advertisement on page III. of Wrapper.)

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

GEORGE GLOVER & CO., LTD.,
CHELSEA.



"THE STANDARD"
SLOT METER.

THE ACME OF SIMPLICITY.
NO SPRING in any part of the mechanism.

Can be fitted with **STRONG BOX,** if desired, or with **"M & M" LOCK.**

LONDON:
RANELAGH WORKS,
ROYAL AVENUE, CHELSEA.
TELEPHONE: Kensington 1140.
WIRE: "Dry Meters, London."

LEEDS:
9, DEWSBURY ROAD,
TELEPHONE: No. 2934.
WIRE: "Meters, Leeds."

MANCHESTER:
GAYTHORN METER WORKS,
EASTON STREET.
TELEPHONE: No. 6893 City.
WIRE: "Slot, Manchester."

SOLE MAKERS OF THE "NOTTA NOS" PAN ASH, DUKE BREEZE & COAL WASHER.

R. & J. DEMPSTER, LTD., 24 & 2266 Manchester

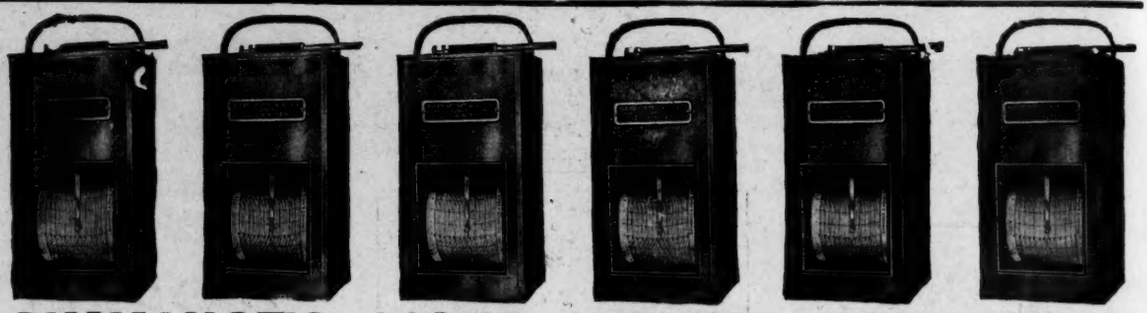
RITCHIE C.I. PIPES FOR GAS & WATER. MIDDLESBROUGH.

WITH **STINGO**
REMOVE ALL GREASE
THEN USE
POMONA BLACK ENAMEL
ON COOKERS AND GAS-FIRES.

DONALD MACPHERSON & CO., LTD., MANCHESTER.

ARROL-FOULIS
Stoking Machinery
HYDRAULIC COKE PUSHERS
(HUNTER and BARNETT'S PATENT.)
WILL DISCHARGE A RETORT IN ONE OPERATION,
LARGE NUMBERS IN USE.

Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
LONDON ADDRESS: 56, VICTORIA STREET, S.W.
[Illustrated Advertisement, June 13, p. 621].



SIMMANCE'S LIGHT WEIGHT NON-LIQUID PORTABLE RECORDER.

Sole Makers: **ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.**
AGENTS: Australia—FYVIE & STEWART, 360, Collins Street, Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

THE DONKIN GAS VALVE.

Fig. 20.

THE DONKIN INTERNAL RACK AND PINION GAS VALVE. ¾-inch up to 48-inch diameter.
Absolute tightness guaranteed. Certificate of test supplied if desired. Faces always kept clean. Large stock of all sizes.

Our Valves have been supplied to nearly every Gas-Works in the British Isles, and very large numbers have been sent to Foreign and Colonial Gas and other Works.

Our output in Gas Valves is over 5000 to 6000 per annum, equal to a weight of 500 to 600 Tons.

BEST WORKMANSHIP AND FINISH.

Makers also of all other types of Valves for Gas, Water, Liquor, and Chemicals.

GAS EXHAUSTING PLANTS. TAR, LIQUOR, AND WATER PUMPS.

COMBINED METER BLOWERS FOR OXIDE REVIVIFICATION.

THE BRYAN DONKIN CO., Ltd.,

Head Offices and Works: CHESTERFIELD.
London Office: MILLBANK HOUSE, Wood Street, WESTMINSTER, S.W.
Chesterfield Telephone No. 84.
London Telephone No. 5358 Victoria.
Chesterfield Telegrams, "Donkin Chesterfield."
London Telegrams, "Donkin Vic. London."

JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXIV., No. 2771.] TUESDAY, JUNE 20, 1916. [68TH YEAR.

EDITORIAL NOTES.

Organization and a Conference.

AT the sources of the directive counsel of the organizations of the gas industry, a very limited idea appears to exist as to what should be the character and constitution of a "central and thoroughly representative organization." The notion seems to obtain that if the easy line of action is taken of just welding together the Council of the Institution, the Council of the Society of British Gas Industries, the General Committee of the British Commercial Gas Association, and the Committee of the Gas Companies' Protection Association, and then calling it a "National Gas Council," this will be the "thoroughly" representative organization that is necessary. Of course, it will not be. It will not be a "National" Gas Council, but simply a Council elected by the principal existing gas organizations; and all those Boards of Directors and Gas Committees who do not think proper to subscribe to the work of the British Commercial Gas Association, and (in the case of Boards of Directors) to the work of the Gas Companies' Protection Association, will be unrepresented from among themselves, and may very properly question the right of the self-constituted "National Gas Council" to speak on their behalf with "an authoritative voice in all matters of policy or pro-"cedure." It seems to us that, if a central organization is really wanted, it is something that is worth taking in hand on bold and comprehensive lines, as indicated in the article, headed "The Half-Way House," in the "JOURNAL" last week. If it is desirable that the central organization should be "thoroughly" representative, then let it be so. If it is desirable that it should speak with "an authoritative voice "in all matters of policy and procedure," then give it the full and flawless right and power to do so.

We have no wish to do anything, or to say anything, that will hinder any really good scheme the promotion of which will serve the interests of the gas industry. Our only desire is that, while this work is proceeding, the industry's forces shall be put into the strongest possible organized condition. To-morrow there is to be a conference—of whom? The Councils and Committees already mentioned! And what is to be the nature of the business before them? According to a circular-letter issued by Mr. W. E. Price, the Hon. Secretary of the Institution of Gas Engineers, it is to consider a resolution proposed by Mr. Alderman Phillips, of Salford, which contemplates the conversion of the assembled Councils and Committees into the "National "Gas Council." That is as far as initiative has managed to reach; but it does not say that the course will be adopted, because Mr. Price in his letter puts it that "past events and "the present serious condition of affairs" show that better organization require "careful and immediate attention." We are glad to see both the expressions—"careful" and "immediate." "Careful" attention may convince the conference that a still bolder scheme is necessary to make a finished job of reorganization in the industry, though, of course, with circumstances of very grave importance bearing upon the industry in these critical times, the National Gas Council might well be immediately set up and maintained in operation pending the natural development of the work of complete organization of all interests. We hope, however—for the reasons outlined in our article of last week—that, at the conference to-morrow, something more will be talked about than the simple fusion of the Councils and Committees in the way proposed; and that, if such a fusion takes place for temporary purposes, it will be clearly announced that a larger scheme for a real premier organization is to be brought under consideration with a view to its materialization.

There is one very hopeful sign about Alderman Phillips's resolution; and it is that he intends the "National" body —whether its title to so broad an appellation be justified or not—to be a live one. The resolution has appended to it a recommendation that an adequately paid executive officer should be appointed. Such an officer for the central representative organization of the gas industry must be a man of many parts and of broad qualifications. He must have large capacity, be wide-awake, industrious, diplomatic, courteous, firm, capable of taking a certain measure of responsibility, and be well acquainted with the past history and present conditions of the gas industry—especially on its legislative, legal, and trading sides. A man of such qualification for the post must be well or (as the resolution puts it) adequately paid. Moreover, an indispensable condition should be that he must not after his appointment be connected officially with any one of the existing organizations, so that he may be absolutely independent, and free from bias or influence.

Technical Journals and the War.

THE "Journal für Gasbeleuchtung," in two recent issues, gives a review of the position of the English gas industry in the year 1915 which is based on the "Retrospect" that appeared in the "JOURNAL" for Dec. 28 last. Before proceeding to quote our comments under the various headings under which we dealt with the position of the gas industry, our German contemporary essays to reprove us for our opening observations on the manner in which Germany has conducted her side of the present war.

Referring to the pre-eminent position in respect of age and standing of the "JOURNAL" among the technical periodicals of the world devoted to gas and water supply, it says that, notwithstanding the good relations which have subsisted for so many years between the German and English technical worlds, the "JOURNAL" must now be reckoned among the bitter enemies of Germany. It quotes our words: "The Germans have proved themselves supreme "masters in the art of cowardly and belial warfare; and "their actions will not be speedily forgotten after the con-"clusion of peace," and then says a journal devoted to technical matters does not appear to be the right place for the expression of such feelings of hatred. Our German contemporary goes on to say that it is instructive to observe how infatuation has penetrated even into technical circles of the English people, and how the desire for the industrial and material suppression of Germany lies beneath the cloak of such "unfair invective." Further quotations from the "JOURNAL" are made, in order to show that the commercial expansion of this country at the expense of Germany is the primary motive which underlies our prosecution of the war.

Our German contemporary, to whose opinions in pre-war days we listened with great respect, seems to have no sense of the complete and permanent upheaval of international relationships which the methods which Germany has chosen to employ in this war have established so far as she and civilized countries are concerned. Sentences from the opening paragraphs of our "Retrospect" which preceded that quoted above, and which serve as its justification, are not referred to by the "Journal für Gasbeleuchtung," but they show that the pages of the "JOURNAL" have not been given over to "unfair invective" against Germany. The invective is more than justified by all the deeds enumerated in our "Retrospect" and by the fearful horrors which have since come to light perpetrated by German professional men of scientific training in connection with the Wittenberg and other Prisoners' Camps. Henceforth the English people are bound to suspect that shameless cruelty lies ready to be awakened in the breast of every German, even though he

be a member of a humane profession such as that of the practice of medicine.

It is against the ambition to attain world-predominance of the nation of which so large a proportion of the component units have proved themselves capable of fiendish cruelties that the people of the British Empire are continuing the present war to the only end which they believe will be consistent with the peaceful existence of other nations of the world—viz., the suppression of the power of the German Empire. Moreover, in order that the present terrific conflict may not be merely the precursor of another like unto it in the next generation, it is necessary before all things that the commercial and industrial prosperity of Germany, from which she has drawn, and would again draw, the sinews of war, should be reduced to a minimum. As exponents of the attitude of one highly important British industry which has wide ramifications, and provides the raw materials for many other industries, we consider that we should be stultifying our position among the world's technical press by refraining from drawing attention to the bearing which the position and progress of a technical industry has on the world's security for peace in the future. There is gratification in the knowledge, that, if the information was not already in the possession of our contemporary, the "Retrospect" was the means of acquainting it with some of the infamous deeds perpetrated in the name of Germany.

Research and Ammonia, Benzene, and Toluene Production.

In the gas industry, we are very much in arrear with research work. Only the fringe of a few of the matters that require investigation had been taken in hand prior to the war; and inquiry into them has not yet advanced very far. And the distance the inquiry has gone has not had any effect in reducing the accumulation of waiting work, for the war itself has introduced fresh problems for solution, especially in connection with the production of benzene and toluene. Taking thought of the morrow, too, there are, in connection with both benzol and sulphate of ammonia, questions that need careful research, in order to put the British gas industry in as strong a position as possible. In the lecture that Professor Thomas Gray, D.Sc., Ph.D., delivered before the Waverley Association, at their recent meeting, he made various suggestions in these respects, and so does Mr. D. R. Wattleworth in another column in a short article on the "Production of Toluene."

Taking Professor Gray's lecture, and the points made in it in relation to this question of research, there are first the problems associated with sulphate of ammonia. The British gas industry must realize the fact that after the war it will have to meet the keenest competition in its sulphate markets abroad from the output of the synthetic ammonia processes; and seeing, as Professor Gray says, that the raw materials for these processes are available from the air and from water in practically inexhaustible quantities, they constitute the chief element of danger to the coal carbonizing industries, since there is no limit to the possible production of fertilizing agents by them. The seriousness of the position is in the commercial direction; for though it is fairly clear from the information so far available that these processes will not be able to render unremunerative the recovery of ammonia in connection with coal carbonization, they can have, and will have unless their competition is properly handled, a disastrous effect on the market prices of sulphate of ammonia produced by gas-works, coke-oven plants, shale-works, producer-gas plants, and so on. This is where Professor Gray is of opinion that investigation is urgent—investigation into all the existing methods of dealing with ammonia as a bye-product of the manufacture of gas for the purpose of determining the best methods of preventing the loss of ammonia, and of converting it into sulphate.

When the nitrogen content of coal, and the theoretical equivalent in sulphate of ammonia, are considered, it has to be admitted that, in showing only a make of a little over 20 lbs. up to 28 or 30 lbs. of sulphate of ammonia per ton of coal carbonized, and in the best coke-oven working 36 lbs., we have a very inefficient process. Retort charges cannot, on account of the coke and the effect on the retorts, be steamed in bulk as in the Mond process. The little steaming that does take place in some installations of intermittent vertical retorts has little effect on ammonia production compared with good working in other installations where there is no steaming, but other conditions are equal. And the idea of our old friend Professor Vivian B. Lewes, as to the running of a proportion of blue water gas into gas-retorts at the rear stage of the carbonization, not only for increasing the yield of gas and the B.Th.U. per ton of coal carbonized, but the yield of ammonia, has not found acceptance. But the supersession of the illuminating power standard by the calorific value one should have its influence not only upon such suggestions, but upon sulphate of ammonia practice in gas-works; and at even quicker pace through the newly proposed calorific value standard legislation—a product of the war [see *ante*, p. 500]—than was at one time imagined. The adoption of the semi-direct process of ammonia recovery in gas-works has been solely retarded by the illuminating power standard; but this obstacle will no longer obtain, where calorific value is the standard. Professor Gray also thinks that the combination of the direct system of ammonia recovery with arrangements for the fractional condensation of tar, upon the lines suggested by Mr. G. T. Purves, calls for the serious attention of gas engineers. If processes of the kind are adopted, there would, of course, be a great saving of the ammonia now lost in storage and transit; and economy is the imperative order of the day. There is likewise still more work required—following that of Mr. Harold Hollings, Professor John W. Cobb, and others—to bring knowledge to a better state regarding the best conditions to prevent the decomposition of ammonia by heat in gas-retorts. The modern practices of carbonization in gas-works have done much in this direction through heavier charges, and the transfer of the ammonia from the retort before the latter reaches its maximum temperature. Even so, when the large proportion of ammonia left in the coke is considered, there is found good scope for work to ascertain the prospects of a greater quantity being brought to book in the sulphate of ammonia account. The present conditions are by no means satisfactory.

Then, again, in connection with benzol and toluol production, there lies before us an extensive field for research work—not only in association with the manufacture of explosives, but owing to the work of development that is offered to the gas industry after the war in the supply of motor spirit and in providing dye substances. Investigation is needed into vertical retort tar, which is not in good repute at the present time among tar distillers. We have heard of this before; Professor Gray in his lecture reintroduces the matter. The mixture of paraffins and naphthenes with the light oils of such tars is not conducive to the manufacture of pure chemicals and explosives; but unless in large proportions their presence is not very material for other purposes. At the same time, the users of vertical retorts do not want their tar production to be any less serviceable than that of other carbonizing systems, unless it is found that it cannot be avoided without detriment to other and more valuable considerations. Yet another matter that invites research is as to the temperatures and size of charges that are best for benzol production. Reference was made to this in the comments last week upon the Presidential Address of Mr. John Young to the Institution of Gas Engineers. Professor Gray also accuses high carbonizing temperatures of destroying a large proportion of the valuable lighter hydrocarbons, and agrees that tars from the smaller works are generally much richer in benzene and toluene than those from the high temperature running works. But while not controverting Professor Gray, it must not be forgotten that just recently the Manchester Corporation Gas-Works claimed a yield of 4 gallons of crude benzol per ton of coal carbonized; and high temperatures obtain there. It is clear that research is necessary to determine the most favourable carbonizing conditions for the production and the preservation of the lower members of the benzene series of hydrocarbons; for it may well be that the development of the benzol business will favour modifications of gas production practices in order to increase the proportion of benzene and toluene in the tar and gas. We cannot say definitely; research, experience, and time must inform us. In Mr. Wattleworth's article, several questions are presented bearing upon the production of benzene and toluene which also offer "splendid opportunities" for research.

These are all matters that are worth looking into; for the gas industry has offered to it fresh lines of service, and only by research can development proceed with any certainty on correct lines.

A Suicidal Policy at Lasswade.

Hearty congratulations may be offered to the Waverley Association of Gas Managers upon their centenary meeting, which was held last Friday week [see *ante*, pp. 596-8], under the presidency of Mr. John C. M'Millan, of Lasswade. The address of the President on this occasion was unique, in that it was mainly a strong indictment of the Company which he manages, but for the policy of the direction of which he is in no way responsible. It makes singular reading in these days when there is one thing the gas industry prides itself upon, and that is its progressiveness. The policy of the Directors of the Lasswade Gas Company appears to be to do everything possible to stunt the growth of the gas business; and the sooner there is a complete conversion of that policy the better for all associated with the concern. Otherwise we can see bad times in store for the Company. The competitors of the gas industry are progressive, and gas undertakings that are not equally so (if not better) must expect to go under.

Retort-Stokers and German Prisoners.

Mr. M'Millan made a suggestion, in the course of his address. It was preceded by a protest against the Government taking the best of stokers from gas-works, while they are looking for such valuable aid from the industry in the matter of the provision of toluol and benzol. Mr. M'Millian has been attracted by the information published some time since in our columns, that in Germany many prisoners of war are compelled to perform stoking and other duties in gas-works; and he cannot understand why, in a similar way, British gas-works should not have the benefit of the labour of able-bodied German prisoners. Britishers are not Germans; and we should be sorry, if managing a gas-works, to have the responsibility of having difficulties increased by employing German prisoners of war. Under the circumstances, about as many Britishers would be required to guard the plant, and see that the Germans did their work, as there were Germans employed. On balance, the result from the labour point of view would, we are afraid, be against the gas-works. We cannot fancy many British gas engineers will agree with Mr. M'Millan in this matter.

Coal and Coke Exports.

Readers who believe as we do that this country's needs in coal should be satisfied before those of neutral countries, will be pleased to see that the Coal Exports Committee continue to keep firm control over the quantity for which export licences are granted. In May, 1914, the amount of coal exported was 6,208,331 tons; in May, 1915, 3,785,794 tons—the then reduction being 2,422,537 tons. But last month the quantity of coal sent from these shores was 3,558,205 tons, so that the reduction on 1914 was 2,650,126 tons, and on 1915 227,589 tons. This is satisfactory, in view of the coalowners' assertions as to shortage of supply in this country. The coke exported in May, 1914, was 75,082 tons; in May, 1915, 61,299 tons; and in May, 1916, 125,295 tons.

Gas-Works and the War.

Shortage in labour has for some time past been the general experience in gas-works throughout the country; but in this regard the Ventnor Gas and Water Company have reached a stage which singles them out from among sufferers from continuous shrinkage of employees through enlistment. The taking at different times from a never very extensive staff of no less than eighteen men, has resulted in placing the Company in a quandary from which they saw no way of extricating themselves; and accordingly letters reproduced in our news columns last week have been addressed by the Chairman and the Secretary of the Company to the Urban District Council. These letters make it clear that the inhabitants are—or, at any rate were at the time they were written—in imminent danger of having their gas supply suspended; and, referring to the matter, a local paper very pardonably remarks that "it is a striking commentary on the defective military and business co-ordination throughout the country, that these circumstances should arise." In spite of strong protest in competent quarters, the men were taken one by one, until at last the irreducible limit was reached—one stoker; and it was when they had come to this stage that the fear was expressed to the Council that the Company might have to curtail the supply of gas to a great extent, if not actually to close-down the works altogether. When the letters came before the Council, some remarks were made about there being no appeals for exemption; and no doubt members forgot for the moment that the employees had War Service badges. Anyhow, the views expressed went to show that there was full appreciation of the seriousness of the position which would arise—particularly in these days of very dear coal—if the supply of gas were cut off; and ultimately it was decided to send the Company's communication to the military authorities. Some little while elapsed between the writing of the letters and the Council meeting; and apparently in the meantime the Company managed to "carry on." This we hope they will continue to do. The incident will, however, serve as a reminder of the difficult situation in which gas undertakings are under present circumstances liable to be placed.

Sulphate of Ammonia after the War.

Those who entertain the comfortable opinion that all will be well with British sulphate of ammonia after the war, and that prices will be well maintained, had better read the translation of the article on the "German Nitrogen Industry and Agriculture," from the "Frankfurter Handelsblatt," which has been forwarded to us for publication by the Chairman of the Sulphate of Ammonia Association (Mr. D. Milne Watson). In connection with fertilizers, Germany is very properly in its own economic interests, and against those of this country, and of the British gas industry, working to reduce its imports of nitrate of soda, and increase its capacity for exporting sulphate of ammonia. Germany is very much alive to its interests in all these matters; and the pity of it is that this country is so often compelled to follow its initiative action. The synthetic sulphate of ammonia process is what is assisting Germany in largely expanding its position and opportunities in the matter of fertilizers; and this is going to be a factor in the future of sulphate of ammonia as a revenue producer. The indications of the article in the "Frankfurter Handelsblatt" are that the production of nitrogen in Germany is going to far exceed our most sanguine expectations. These indications must not be neglected; they are insistent as to the necessity of developing the home market and consolidating markets abroad. The application of sulphate of ammonia per acre of land is much enlarged in Germany; and the land has doubled its yield—a very necessary condition in days of blockade. This home development has been the result of encouraging farmers' associations and agricultural schools, the employment of modern methods, and cultivating the extended use of fertilizers. Though the home use of sulphate of ammonia has been extraordinarily rapid in Germany, there was a substantial surplus available for export before the war, and there will be more after. This has to be remembered, and the information utilized.

British Engineers' Association.

Only a few weeks ago, in these columns, reference was made to efforts to establish a central organization of manufacturing interests, with the object of strengthening and uniting the industries of the United Kingdom. Other steps, having a protective object, are now being taken, though this time they refer to a particular branch of trade—engineering. In view of what it is probable the future has in store for business interests in this country, the need for the organization of the British engineering trade is felt to be pressing; and hence firms are being invited to join a body already in existence, whose aim is the safeguarding and promotion of our trade in this particular line. The name of the organization is the British Engineers' Association; and at present it embraces 300 firms, with a combined capital of over £100,000,000, consisting entirely of British subjects. In asking those who are not already members to join up, the Association express the view that the time has come for their industry to show the country it believes in organized self-reliance, and is prepared to maintain the supremacy of British engineering against all comers. There is not likely to be disagreement in any quarter with the assertion that the first practical step towards this end is mobilization. It is fair to say, however useful the work done by the Association during its four years' existence may be, a far larger field, and more vital problems, lie ahead. For this reason, if for no other, careful consideration will doubtless be given to the invitation to join, which is signed by Mr. Wilfrid Stokes as President, and Sir J. E. Thornycroft as Chairman of the Executive Committee. Among the objects included in the Association's immediate programme, are to induce the Government to recognize

them as the body to consult on all matters that concern the engineering industry, and to urge the Government to place the industry in a position for competing successfully with enemy countries after the war, and not to hamper it with legislation and conditions that handicap it. There is nothing in this programme but what is likely to meet with the hearty support of British firms. It is urged in the circular that, while the present war is admitted to be an engineers' war, the engineering trades have not received, either in peace or since the war began, the consideration which is their due; they have not been able to exert an influence which engineers believe would have been beneficial to the country. And it is added that the reason for all this is that they are not mobilized on an adequate scale.

Daylight Saving in France.

France has at length definitely resolved upon the adoption of the summer daylight saving system; and last Wednesday all clocks were put on one hour, and will remain "on" until the night of Sept. 30. Paris loves its outdoor life; and it is believed that, owing to the military regulations that deprive the people of the capital city of their late-hour café and restaurant pleasures, there will be a greater proportionate saving of artificial light in France than there is in this country. The regulations compel every café and restaurant and similar establishment to close at 10.30; so that, until the evenings begin to shorten again, barely half-an-hour's artificial lighting will be required by them. Most of the clubs in Paris, too, close by order at eleven o'clock during the war. We should, however, imagine that for Parisians, the closing of the cafés and restaurants, &c., does not mean retirement to bed, and that the consumption of the means of artificial lighting will simply be largely transferred from the places where people have hitherto assembled to their individual homes, so actually more than compensating for the lavish illumination in those places where they formerly assembled nightly. This year for France, the daylight saving scheme only operates for three months and two weeks, so that really this is not a very serious matter when the balance is struck between the reduction in lighting in some directions and the increase in others. Some folks doubt whether "daylight" saving is a proper description, and urge that artificial light saving would be a more appropriate one. We are not so sure. A one-hour per day universal saving of artificial light is problematical; the one hour's universal saving of daylight is not, unless people madly refuse to conform their habits to the new time.

A Suggested Benzol Association.

In an article dealing with the development of the recovery of benzol, the "Iron and Coal Trades Review" looks forward, and makes the following remarks and suggestion: "Very little so far has been done towards the creation of a dye industry in this country anything nearly sufficient in scope to meet the national needs in normal times. It behoves us, therefore, to keep in mind the necessity of formulating some scheme of effectually disposing of our benzol after the war, so that all existing benzol plants can be kept fully employed. It seems to us some kind of Benzol Association—on the lines of the Sulphate of Ammonia Association—might be formed with advantage to develop the use of benzol for any commercial processes. We have had convincing proof of its suitability as a motor spirit; and this would probably be the most satisfactory outlet for it in this country. But it will need encouragement and careful handling, or we shall see even this outlet closed by the machinations of the petrol industry."

Centigrade or Fahrenheit Scale.—According to the "Iron Age," Dr. Carl Hering presented, at a recent meeting of the American Electrochemical Society, a resolution endorsing a Bill now in Congress to the effect that in all Government publications the Centigrade scale should ultimately be substituted for the Fahrenheit—probably at the end of four or five years. The resolution was adopted unanimously. In the meantime, the two scales are to be used side by side.

Revision of Certified Occupations.—A revision of the complete list of certified occupations is at present in progress. Pending the issue of the full list, it has been arranged with the Army Council that men in stated occupations should be treated as in certified occupations, and added to the list of May 1. The new list includes: Fertilizer manufacture (sulphate of ammonia, superphosphate, basic slag, and compound manures): Chemist (30), foreman, overlooker (30), process man (man in charge of any chemical process) (30), grinder, loader, slag breaker, slag millman (30). The figures indicate the age up to which single men are not exempted.

PERSONAL.

By the unanimous vote of the Directors, Mr. HENRY WOODALL, M.Inst.C.E., J.P., has been elected to the vacancy on the Board of the Croydon Gas Company, which was caused by the death of his father, Sir Corbet Woodall.

At a meeting of the Board of the Bournemouth Gas and Water Company, last Friday, the Right Hon. Sir DANIEL F. GODDARD, M.P., was unanimously elected to fill the vacancy on the Directorate of the Company occasioned by the regretted loss of the late Sir Corbet Woodall.

As the result of a re-organization of the staff, under which independent responsibility is being given to various departments, Mr. R. C. MACDONALD, formerly Works Manager to Sir William Arrol and Co., of Glasgow, and later Resident Agent in connection with large constructional contracts, has been appointed Chief Mechanical Engineer to the South Metropolitan Gas Company. Mr. G. M. Gill (Chief Engineer), of course, remains the head technical officer of the Company. It may be added that Mr. Macdonald had years ago a considerable amount of experience in connection with the development of the Arrol-Foulis stoking machinery.

The Birkenhead Town Council have agreed to a recommendation by the Gas Committee that Mr. T. O. PATERSON (the Engineer) should be released from duty at the end of this month, and appointed Consulting Engineer at a salary of £350 per annum. Mr. Paterson commenced his service with the Corporation 36 years ago; and in moving the Committee's minutes, the Chairman (Alderman M'Gaul) said they felt they were losing the valued services of a long-tried and faithful servant. The first step towards the appointment of a successor has been taken by the insertion in this number of the "JOURNAL" of an advertisement inviting applications. Meanwhile, Mr. Paterson has undertaken to place himself unlimitedly at the disposal of the Committee.

Mr. JOHN BRODIE has taken up duty at the Gas-Works, Aberfeldy, as Manager. He has acted as Assistant Manager at Dalkeith for six years.

At the annual meeting of the Okehampton Gas Company, the Chairman (Mr. Thos. Jessop) referred to the fact that they had lost the services of Mr. S. R. HARRY (their Secretary), who had joined the Colours. They all wished him a safe and speedy return.

The St. Helens Town Council have appointed Mr. A. W. BRADLEY (the Borough Engineer and Surveyor) to the post of Water Engineer, rendered vacant by the resignation, after many years' service, of Mr. J. J. LACKLAND, which was notified some ime ago. Mr. Bradley will, in addition, retain his present office.

We are gratified to note in the list of those mentioned in Sir Douglas Haig's recent dispatch for distinguished service at the front, the name of Second-Lieutenant E. H. CLARRY, Assistant Engineer to the Cardiff Gas Light and Coke Company. Lieutenant Clarry, who is the youngest son of Mr. George Clarry, went to France in June last with the 6th Welsh, and was Acting Adjutant under the late Lieutenant-Colonel Lord Ninian Crichton-Stuart. About six weeks ago he was invalided home, and had to undergo an operation to the knee in the London Hospital. He is now recuperating on sick leave. Lieutenant Clarry is, we learn, known to have been in several tight corners in trench work; but he has been too modest to even hint in his letters at any particular exploit which has merited the present distinction. Captain Pearson Bell, who was recently awarded the Military Cross, and Lieutenant Clarry are the only Cardiff officers in the 6th Welsh, which is mainly recruited from the Swansea area; and the battalion can now boast of sixteen "mentions in dispatches."

OBITUARY.

SILVANUS P. THOMPSON, D.Sc. LL.D., F.R.S.

By the death, on Monday last week, after only two days' illness, of Professor SILVANUS P. THOMPSON, D.Sc., LL.D., F.R.S., science has lost one of her devoted servants. His official position was that of Principal of the City and Guilds Technical College, Finsbury; his real position, one of the brilliantly gifted few at the head of our learned ranks. He was a physicist and a scholar of many distinguished parts. All our technical readers knew him by repute, and through his extensive work; and several, too, had met him in connection with the Illuminating Engineering Society, of which he was the first President, remaining in that capacity until it had established itself firmly as a living force among our technical organizations, and doing useful work in the study and discussion of the problems of scientific illumination. He was eminently fitted for the position of President, for in a Society based on the principle of impartiality in respect of agents, and caring only for the advance of illumination on scientific lines no matter its source, it required a head in whom members, with opposing commercial interests and individual predilections, had confidence. His personal qualities and scientific accomplishments—though he was always unassuming, quiet, and courtly—made him a strong man among men. Wherever he was, whatever his surroundings, there was always the keen intellect at work, and always the same happy demeanour. Physical science was

his work, and electricity and optics the two branches that chiefly claimed his attention. But his knowledge and intellectual interests were so wide and so deeply rooted, that there was nothing little or narrow about him. Only last month, in the absence of Sir William H. Bennett, his successor in the chair of the Illuminating Engineering Society, Professor Thompson referred in feeling terms to the loss of such colleagues in the work of illumination as Mr. Edward Allen and Professor Vivian B. Lewes. With him science had no bounds; and his special interests merged themselves into the interests that were special to other men. Born in 1851, Dr. Thompson was appointed a Professor at Bristol University College in 1878; and in 1885, he was elected to the Chair of Physics at the City and Guilds Technical College, of which, as already stated, he afterwards became Principal. He was largely consulted on matters appertaining to electricity, especially in connection with new processes and new mechanisms. His scientific contributions to literature were many and valuable, not only in the form of standard books but as papers to learned societies, of many of which he was a member. He helped to mould the lives of many men; and their debt and the debt of electrical science to him were beyond recompense. But his work is his memorial; and the world is the richer for the service he has rendered to it.

Mr. WILLIAM DAVISON, who died last Thursday, was for many years Manager of the London and North-Western Railway Company's gas-works at Crewe. He was 79 years of age. At the local Mechanics' Institute he did much to assist the student—taking always, as he did, a great interest in scientific education.

The death is reported (in the last number received of our German contemporary), as having occurred on the 2nd of March last, of Herr OTTO KROMSCHRÖDER, of the firm of gas-meter manufacturers whose original works were established at Osnabrück, and of which there are branches in many parts of Germany, and in Brussels, Zwolle, Barcelona, and Buenos Ayres. Herr Kromschröder learned the gas-meter business in the works of the Gas-Meter Company, in London, of which Company a branch was established at Osnabrück in 1864 in the charge of one of his brothers. In 1866, this branch was given up and Otto Kromschröder returned to Germany and, with two brothers, founded their own business in Osnabrück. It is the oldest gas-meter works in Germany and was the first to produce dry meters. The growth of the business is shown by the fact that in the year 1914 the output of the firm was 80,000 gas-meters, including prepayment meters.

The death occurred, last Saturday week, from affection of the heart, of Mr. W. C. DAWSON, who was formerly Manager of the Arundel Gas Company, from which position he retired on a pension. Deceased, who died at Nottingham, was in his 67th year. He had a breakdown at Brighton in the early part of last year, and had been very ill at times since then. Mr. Dawson served his time with the Grantham Gas Company, and was appointed Manager of the Uckfield Gas Company about 1874. Two years later he became Manager of the Arundel Gas Company, which post he held until 1908. He took to his bed only a few days before the end came. The remains were laid to rest at the Rock Cemetery, Nottingham, last Wednesday; and among the mourners, besides the family, were Mr. John Wilkinson, of Nottingham, Mr. G. R. Casterton, of Melton Mowbray, Mr. H. Wimhurst, of Sleaford, and Mr. J. Mackenzie, of Nottingham. Mr. Dawson left a widow and two married daughters.

COAL SUPPLIES: NATIONAL ECONOMY.

> It is but one of the incidents of the great war of the United Kingdom and her Allies against the Central European Powers, that national interests, as well as public opinion, demand that the natural and native resources of the Empire shall be made available to serve to their maximum capacity the first requirements of the country.—*Chamber of Commerce Memorandum.*

[COMMUNICATED.]

THE coal statistics produced at the Manchester Conference, and reported in these pages on the 23rd ult., show, as Alderman Phillips aptly remarked, "the picture of a restricted output creating an artificial scarcity." The Manchester Conference is not merely an incident arising out of the great war; for Parliament's attention is thereby directed to the threatened danger underlying a dilatory policy.

In issuing a reminder that British coal is an asset to be jealously preserved, and a powerful factor in strangling German trade and the German economic position after the war, the Board of Trade addressed light, heat, and power undertakings, as though the latter were the saviours of the situation, on whom devolved the responsibility for preserving the whole economic position intact.

The supply and use of coal has ever presented contentious phases. It is believed that coal was used in this country as far back as the First Century; but it was towards the close of the Thirteenth Century that it was employed in London, when it was at once opposed as being injurious to health. In 1306, as the outcome of a parliamentary petition, a Royal Proclamation was issued against its use; but necessity, which knows no law, ultimately had her own way. Recent investigations fixed the approximate extent of available coal; and while there is no cause for uneasiness on this score during the next few hundred years, the matter of cost presents an alarming view.

But to go back to the Conference. The hypothesis that the pressing difficulty of public utility undertakings would disappear if coal is produced at the rate per person employed per annum in the period 1886-90, is one thing; the hypothesis of cost at the pit's mouth if the amount produced per person employed per annum had improved proportionately with that in the United States and the Colonies, is another. Substituting the normal 260 tons in 1911 for the abnormal 244 tons in 1912 (the strike year), the Manchester statistics show:

	Get per Person per Annum.				Pit's Mouth Cost (omitting pence fractions).		
	1886-90.	1912.			1887.	1912.	
	Tons.	Tons.	Tons.	Per Cent.	s. d.	s. d.	s. d.
United Kingdom.	312	260	− 52	= 16·7	4 9	9 0	+ 4 3
United States.	400	660	+ 260	= 65·0	6 6	6 1	− 0 5
Australia	333	542	+ 209	= 62·7	9 2	7 6	− 1 8
New Zealand	359	503	+ 144	= 40·1	10 10	10 11	+ 0 1
Canada	341	472	+ 131	= 38·4	—	—	—
	1433	2177	+ 744	= 51·9			

Thus, while the American and Colonial output has improved 52 per cent., that of the United Kingdom has declined 16 per cent. A difference of 68 per cent. in working is surely a travesty on the situation proper if it is contended that mining difficulties are responsible, seeing that this difference has sprung up since 1887, and that mining lengths and depths are not likely to diminish in the next few centuries.

The increased cost is obviously not due to physical disadvantage. In the other places mentioned, the financial effect of better pay and improved conditions of employment has been discounted by better working results. If such is the effect *outside* the United Kingdom, why is it not procurable *inside?*

Assuming that working conditions are comparatively similar, that syndicalism gave place to enlightenment, and that a broader view encouraged machinery and increased output, the quantity per person employed per annum ought to be 473 tons, effecting a saving of something like 5s. per ton on the 253,000,000 tons obtained last year, or (say) £60,000,000 per annum. The incidence of this unnecessary burden may be gauged from the 1903 basis of home consumption.

	Per Cent.
Mines	10·8
Factories	31·7
Metal industries	17·4
Brick, pottery, glass, and chemicals	3·0
Gas-works	9·0*
Railways	7·8
Coasting steamers	1·2
Domestic purposes	19·1
	100·0

* Now approximately 7·1 per cent.

Five shillings a ton of coal! Since the outbreak of war many have realized the significance of the phrase; but probably few have paused to consider its effect upon the national and international standpoints. M'Culloch remarked: "No improvement could be equal to a reduction in the price of coal." Whether cost of production does or does not affect coalowners' profits, there seems little or no doubt about uncontrolled coal profits affecting output; and it is certain that the incidence of the double burden ultimately finds its way to the public, and, in a compound form, to domestic life. In the case of the gas industry, assuming that a common "war" price of 2s. 3d. is the equivalent of (say) 1s. 11d. under normal conditions, and allowing 3d. as the effect of a reduction of 5s. per ton for coal (taking into consideration its effect upon residual products), with a further 3d. for the better employment of capital and standing charges, gas would probably be sold at 1s. 6d. per 1000 cubic feet, or 30,000 heat units per penny. At this figure smoke abatement would be nearer accomplishment, fogs would largely disappear, and the clearer atmosphere resulting therefrom would automatically extend the Daylight Saving Act into the winter months.

The cheapening of supplies for home consumption would add incalculably to our national wealth, and enhance our international economic position. But it is characteristic of our race to fetter and render difficult those things which might otherwise be comparatively simple; and our obvious weakness is to be found in rigid, antiquated, and inadequate systems.

No one can as yet measure the effect of the enormous financial drain caused by the war, or say what the Empire may later be called upon to do through fiscal necessity; but national interests can never be promoted by unpardonable waste. The immense sacrifice of human life demands that each should do his utmost; and we should remember that when the war is won, every nerve may have to be strained to conserve, in an economic sense, the fruits of victory.

Coal, as one of the greatest of our natural and native resources, should be made available to serve to its maximum capacity the first requirements of the country; and in this matter Parliament's responsibility is clear and its duty obvious. It could at once arrest a criminal waste of national resource, and set free some £60,000,000 per annum without injury to any, but with benefit for all.

NATIONAL GAS ORGANIZATION.

Sir,—I enclose a copy of a letter which has been forwarded to the Secretaries of the Institution of Gas Engineers, the British Commercial Gas Association, the Society of British Gas Industries, and the Gas Companies Protection Association, with a request that a copy be sent to each member of the Council or General Committee of each body.

W. E. Price, Hon. Secretary,
Institution of Gas Engineers.

Gas-Works, Hampton Wick, June 14, 1916.

[Enclosure.]

Organization of the Gas Industry.

June 10, 1916.

Dear Sir,—The feeling has been strongly held in many quarters for some time past that there is need of some recognized Central and thoroughly representative organization, to which could be referred questions, or which could initiate discussion and, when necessary, action in matters of general interest to the industry. It is felt that this representative organization should be one which would, as a matter of course, be consulted by any undertaking, or group of undertakings, before action was taken on any matter of common interest; so that there would be co-ordination of action and agreement of policy whenever possible.

The National Gas Committee was formed in 1914 for the purpose of safeguarding and promoting the interests of the gas industry. This Committee is composed of twenty-one members—seven members appointed by the Institution of Gas Engineers, seven by the British Commercial Gas Association, and seven by the Society of British Gas Industries; and meetings can be called at any time at the request of the Council of any of the bodies of which it is composed.

The above subject, owing to war emergencies having recently become acute, has lately received the attention of this Committee; and a meeting was held on June 5, when it was fully discussed. It was felt that past events, and the present serious condition of affairs in such matters as coal supply, coal prices, shortage of labour, and other pressing subjects, showed that better organization required careful and immediate attention.

The National Gas Committee do not think that they are of sufficient size, nor fully representative of all interests in the gas industry, and they are of opinion that a "National Gas Council" should be formed, as indicated in the following resolutions which were moved by Alderman Phillips, of Salford, and unanimously adopted at the meeting above referred to.

"That the interests of the gas and allied industries render it advisable to form a National Gas Council, to be representative of all sections of the industry, to speak with an authoritative voice in all matters of policy and procedure."

"That the proposed National Gas Council shall consist of the Presidents, Vice-Presidents, and respective Councils of the Institution of Gas Engineers and the Society of British Gas Industries, and the General Committee of the British Commercial Gas Association, and the Committee of the Gas Companies' Protection Association."

"That it be a recommendation that an adequately paid executive officer be appointed."

For the purpose of discussing the matter, and consolidating the proposals contained in the resolutions, the National Gas Committee have arranged for a Conference at the Westminster Palace Hotel, Victoria Street, London, on Wednesday, June 21, at 5.30 p.m., at which they hope the whole of your Council (or General Committee) will be present. May I ask you to be good enough to issue notices of the meeting as soon as possible?

(Signed) W. E. Price, Hon. Secretary,
Institution of Gas Engineers.

ELECTRICITY SUPPLY MEMORANDA.

It is a human failing to defer doing those things which may be very useful and valuable in the time of extraordinary stress, but the importance of which is not so apparent in the days that are free from extraordinary turmoil. However, there was very good cause shown, even in peaceful days, for the interlinking of electricity undertakings. Collapses of supply, station fires (which sometimes cut-off the service of electricity for days, inconveniencing householders, and plunging the at one time trustful manufacturers into perplexity and heavy loss), distribution defects, and other causes again and again stirred up the question of interconnection. But little was then done. The old jealousies which the satirical label "parochial" did not favour the linking-up idea, any more than some people did at one time the Channel tunnel scheme for the more effectual bonding of France and England. To interlink seemed like the beginning of amalgamation and absorption into larger electricity supply schemes. Now the idea has been revived, as seen lately, by the Board of Trade, with the view of producing fuel economy—a matter which took second place in consideration when interlinking was originally proposed. Upon the Board issuing their circular on the subject, there were critics who saw engineering and technical difficulties in the way of immediate compliance. But the engineering and technical difficulties are not universal; and there is a large balance of concerns that are eligible for a working alliance. For instance, the "Electrician" can see that one immediate effect of interconnection would be the closing-down of many of the small stations, and the supply in bulk to them from the larger and more economically worked ones. There cannot be any complaint against the movement. Economy is the order of the day; and to that end the process of absorption of small undertakings by the larger ones has been going on in the gas industry for some years, with benefit to the districts previously served by the former. That is what is in contemplation now in the electricity supply industry. The small steam-run station is very wasteful; and the charges are high. This is to the benefit of the local gas undertakings. But if, through the aid of the larger generating stations, waste is to be superseded by economy, and current is to be made available at lower rates, the local gas undertakings will be put on their mettle, and those dear old slow-coach gas directors or committeemen who will not follow their progressive gas managers will find that the policy of the mid-Victorian age will not give them and the business any protection in these times.

Economy in Interlinking.

Want of Co-ordination in High Places.

We have in this linking-up scheme another illustration of that utter lack of co-ordination that has been existing in Government departments during the war—one department prescribing certain courses of action without exercising any foresight as to the effect upon the work of other departments. We have seen it in connection with coal savings and munitions—the Board of Trade desiring (thus assisting the interests of the coalowners) to save gas and increase the exports of coal to neutral countries, while the Ministry of Munitions want to progressively enlarge the supply of high explosives to our Army, Navy, and Allies. The Board of Trade have recommended the interlinking scheme for the purpose of saving coal; but the Hammersmith Borough Council point out that, since the war started, those in high places who have forbidden the outlay of capital refused to allow the expenditure of money for the interconnection of the Battersea, Fulham, and Hammersmith concerns; or rather, to put it precisely, the Treasury said they could only sanction such capital expenditure as was urgently necessary for the effective maintenance of the existing electricity supplies. Whereupon the London County Council (who have control over the capital expenditure of the London municipal electricity undertakings) limited the cost of linking-up to the Battersea and Fulham undertakings. Hammersmith, therefore, had no alternative but to withdraw from the scheme. Now, in view of the Board of Trade communication, the Hammersmith Council are pressing upon those who vetoed their participation in the original scheme, the desirability of at once completing it. The County Council, too, are moving. Evidently they see a chance of getting in the thin end of the wedge which will open the way to that consolidation of electricity supply which they have for some time longed for in connection with Greater London and its environs. At a conference of municipal electricity authorities in London, Mr. Hume, the Chairman of the County Council Electricity Committee, stated that the Council had had prepared a comprehensive scheme of interlinking, seeing that the matter was urgent now, and would be still more so after the war. At the conference, a resolution was passed to the effect that the authorities represented would do everything in their power, *within their local areas*, to carry out the object of the Board of Trade. This does not bind them to accept interlinking as the best possible way of effecting economy.

Ways and Means under Current Conditions.

When electricity undertakings find their fuel expenses have gone up by 50 to 80 per cent. (even 100 per cent. is mentioned), and the price of other materials by 20 per cent., and when, on top of reduced street and shop lighting, the Summer Time Act is inflicting heavy blows upon the residential lighting load (which is so important to the majority, especially those not favoured with a great demand for munition work), there is need to look into the question of ways and means, and see whether there is anything in the old methods of trading that does not fit the present time, and that it would be economical to abandon. The effects are rather curious. For example, the Blackpool Electricity Committee have decided that no further applications for supply under the rateable value tariff shall be accepted during the war. Apparently the system is not sufficient to stand the strain of war conditions; and small wonder when a certain paper is remembered which showed that, in normal times, in certain important towns, the consumption per consumer had gone up enormously under the system, while the revenue was less per consumer than before the system was adopted. Then the Finchley Borough Council have decided to suspend during the period of the war the clause in the general conditions of supply relating to free service connections; and it is also seen that in Belfast new consumers have now to pay the cost of service connections and meters. All over the country, too, in places where there is large reliance on the domestic lighting load, there are many authorities who are already finding it necessary to advance prices owing to the effect of daylight saving. As previously stated in the "Memoranda," there is now a fairly extended application of the minimum charge—usually 13s. 4d. (20 units at 8d. per unit). Those consumers who have complained of this in letters to the electricity suppliers and to the

daily Press have small comfort meted out to them by the "Electrical Times." It says that "the obvious reply is that the Summer Time Act was intended to save coal, and if, in addition to the adjustment of the time table, the undertakers raise the price of their commodity, this will help to further the laudable object in question." If our contemporary will read the debates in Parliament on the subject of daylight saving, it will see that the national saving of money on artificial lighting was the paramount consideration; yet our contemporary says in justification for increased prices per unit, and the infliction of the minimum charge, that the "idea was not to save the individual householder expense." Of course it was. However, electricity concerns must pay their way; and the estimates of reduced domestic consumption through the operation of the new Act are fairly heavy in the case of some electricity undertakings. Meantime, the electrical papers are ringing the joy-bells over the showings of the past financial year's working of electricity undertakings in specially favoured areas—Barrow, Birmingham, and Manchester for instance. But what of the majority of electrical concerns?

Slips in Meditation. "A Meditation on the Latest Gas Circular" by a "Station Engineer" has been published by the "Electrical Times." The meditation took the wrong turning, and assisted the engineer in making an ass of himself. The circular, it is stated, emanated from the British Commercial Gas Association. There is one point particularly noticeable about the article; and it is that the "Station Engineer" carefully avoids all direct consideration as to whether or not the figures presented in the circular are true. What he does is to get away from the figures, and present others with a view to proving inaccuracy by the aid of that most feeble of weapons—satire. The circular states the prices at which electricity must be supplied if gas is sold at certain figures per 1000 cubic feet, in order to obtain at any given cost an equivalent amount of light, by metallic filament lamps in comparison with inverted gas-lamps. The figures are not assailed by the "Station Engineer" who has indulged in meditation. Take the case of electricity at 3d. per unit, the circular shows that the equivalent price of gas when converted into light could be 7s. 4d. per 1000 cubic feet. Take another case where gas is supplied at 2s. 4d.; electricity must be supplied at ¾d. per unit to compete on the light basis. If the "Station Engineer" will meditate over the point, he may remember that the metallic filament lamp, if credited with a uniform efficiency of 1 candle per 1·25 watts, will supply the user with 800 candle-hours per unit. With low-pressure inverted gas-burners the efficiency is from 20 to 25 candles per cubic foot of gas, according to burner and composition of gas. It is easy enough with a 500 B.Th.U. gas to obtain the efficiency of 20 candles per cubic foot; so that 20,000 candle-hours can be realized per 1000 cubic feet. To obtain 20,000 candle-hours with electricity and ordinary metallic filament lamps, 25 units would be needed. If the efficiency of the inverted gas-burner is 25 candles per cubic foot, then 1000 cubic feet will supply 25,000 candle-hours, to secure which with electricity and the ordinary metallic filament lamp 31 units would be required. Now perhaps the meditating "Station Engineer" will tell us whether or not these figures are true; if not, the grounds—photometrical and otherwise—upon which he asserts they are untrue. If our figures are true, then will he devote a little further meditation to the figures published by the British Commercial Gas Association, and show us where they are inaccurate? His meditation has only carried him to the point that the figures cannot be correct, because, with 2000 lighting consumers whose gas bills "would" average over £4 per annum, his revenue for current for lighting should be 2000 × £4 × 3 or 4 (the extra cost of electric lighting); and the revenue is nothing of the kind. Probably the gas consumers did not use "over" £4 worth of gas for lighting only per annum. Probably, too, the electricity consumers, owing to the relative dearness of electric lighting, are more frugal over it than they were in the days when they could revel in a large illumination at a comparatively small cost. Perhaps the "Station Engineer" would like to make some photometrical and meter tests to help him in his further meditations. If so, doubtless the opportunity could be arranged for him, if he will publish the results broadcast in his own district. If he will not publish them, perhaps he would have no objection to the local gas people doing so. Of these gas people, the anonymous "Station Engineer" does not think much, for he says the circular "bears the stamp of the local gas company; but they have not—well, the technical equipment needful to obtain results like those given in the leaflet."

At the Seat of Coal Saving. The unsagacious advice of the Coal and Coke Supplies Committee to the Board of Trade, as to the consumption of gas and electricity being reduced to the equivalent of 10 per cent. of the coal used for lighting purposes, seems likely to permanently affix itself to the department in question. There are some things that live long. "Wait and see," for example, will have a longevity far exceeding the life of a certain Prime Minister; but the philosophic remark will always assist to keep his memory green. Just in the same way, the 10-per-cent.-coal-saving-for-lighting circular will live in memory to a grand old age; and it will frequently be quoted as one of the humorous pieces of Departmental counsel that specially appertains to the great war. How the practical difficulties associated with the request were to be overcome have never been explained by the Board. How, for instance, there was to be discrimination between the consumption of gas for different purposes when the total was registered through one meter, has never been determined by the Board or their advisers. One of the most sensible replies yet made to the circular has been that of the Marylebone Borough Council Electricity Committee. The Board, according to "Electrical Industries," have been informed by the Committee that "everything possible has been done to reduce the consumption of coal at the generating-station." That is the place where economies, if possible, should be effected. If all the waste of fuel, and destruction of value resident in coal, that proceed at electricity generating-stations could be eliminated, there would be a substantial saving of coal from that one quarter alone. Boiler-houses are places where there can be, and frequently is, tremendous waste. In gas-works, there has been considerable advance in coal economy through the increase of the quantity of gas made per ton of coal; and never has the thermal efficiency of the carbonization process in gas-works been so high as it is to-day. In other manufactories and processes, too, there is room for economy. In short, if all the sources of waste at the seats of industrial fuel use contributed to saving, there should be greater effect than trying to get consumers of gas or electricity for lighting purposes to reduce their utilization of light by 10 per cent. How the greater number of gas consumers are to know whether they have managed to get down to a 10 per cent. decrease of the coal used for the provision of their light is a problem that is our master. Where electricity is only employed for lighting, the tale of the meter would be sufficient. However, we do not think the Board of Trade will trouble much about inviting further replies to their inquiry as the results of the steps taken to effect the 10 per cent. reduction in lighting on consumers' private premises. We rather think, they have heard enough of the 10 per cent. coal-saving circular, and will not feel very disposed to revive in people's minds the absurdity of it.

Wiring "Rules" Revision. It was only the other week reference was made in the "Memoranda" to the issue of the revised wiring rules of the Institution of Electrical Engineers. It is a question whether electric wiring will ever become a perfect art. The wiring rules have been revised again and again; and, each time of revision, defects have been subsequently discovered, with the result that there has had to be further revision. When the recently issued wiring rules were under notice, most of the reviewers found something or other at which to kick. Now an "Engineer" has written to one of our contemporaries suggesting that the rules should be further revised at the earliest possible moment—that is to say, as soon as war work permits. A practical suggestion is made by "Engineer;" but from it the Wiring Committee of the Institution may draw the inference that at the source of the suggestion the view is entertained that those who undertake the revision of the rules do not thoroughly understand the work. His suggestion is that there should be added to the Committee the names of some wiring experts well known for their prolonged efforts to raise the standard and the status of this branch of electrical work. There is intended to be a little sting in the tail of the letter. "The majority of the Committee should," he writes, "be men whose work has been mainly wiring. Many engineers eminent in other branches undervalue the importance and complexity of wiring problems and practice." Once before we "thanked goodness for the simplicity of the method of transmitting gas." We do so again, and ardently.

Automatic Gas Street Lamps.

An automatic gas lighter has been devised by the Automatic Gas Lighting Equipment Company of Boston, Mass. The "Bulletin of the American Commercial Gas Association" says it consists of a clock box attached to the lamp standard, while the clock mechanism in it operates a tripping lever controlling a double-acting valve. When the gas supply is open, the pilot supply is closed, and *vice versâ*. The pilot comes up through a small hole in the centre of the gas-cap, and the flame may be adjusted to use 0·1 or 0·2 cubic foot per hour. The lighting and extinguishing times are regulated by a control dial inside the clock box. The device has been used in from 100 to 1000 units at Newton, Fall River, Gardner, and Quincy, Mass., and other cities. It is claimed that one man can easily look after 250 to 300 of these machines and lamps, &c.; and that the cost of running a lamp so equipped, including labour, mantles, chimneys, globes, domes, clock repairs, depreciation, and interest at 10 per cent., is about $6 per annum. The cost of street lighting where hand extinguishing and lighting is employed is from $24 to $30 a year.

Institution of Water Engineers.—The twenty-first summer meeting of the Institution—the President (Mr. F. W. M'Cullough, J.P., M.Inst.C.E.) in the chair—will be held on Friday afternoon of the present week, in the apartments of the Geological Society, Burlington House, W. Two papers are down for reading and discussion: "The Alignment Diagram Applied to the Flow of Water in Uniform and Compound Mains," by Mr. D. Halton Thomson, M.A.(Cantab.); and "Plans and Records of Water Distribution Systems," by William P. Walker.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Annual Meeting and Report.

As already announced in the "JOURNAL" would be the case, the Société Technique de l'Industrie du Gaz en France have again suspended the annual congress which, until the outbreak of hostilities, formed its chief public work for many years past and was the medium for the communication and discussion of numerous papers on the technical and chemical questions connected with the gas industry. The continuity of the assemblies has been maintained in a formal manner by the annual meeting held last Friday week, June 9, and limited to the adoption of a report for the year ended May 31 and the transaction of a few items of official business. Among these latter were certain modifications in the regulations required by the official distinction which has been accorded to the Society by the order of the President of the French Republic, in the shape of its designation as a "body of public utility." This mark of national approbation is one which the Society are gratified at having at length received, as it is assuredly one which they have long deserved.

The membership shows a slight decline—830 on June 10, as compared with 879 on July 1, 1914. The reduction is due chiefly to death and retirement, coupled with the fact that the exceptional times have been unfavourable to new accessions. Notable among those who have been lost to the Society by death are: M. M. J. Ancel, a Past-President; M. J. de Brouwer, of Bruges, whose decease has taken place since the German occupation; M. Ch. Charpentier, M. Gailliard, M. Gaulis, M. Armand Grebel, M. Guidet, M. Schauffler, as well as two English honorary members—the late Mr. Edward Allen and Mr. Joseph Hepworth.

In accordance with the constitution of the Society, six members—viz., MM. Bachelay, Delebecque, R. Ellissen, R. d'Estape Frère, Masse, and Séguin—were elected to serve on the Council for two years and MM. G. Gautier, Kœuffer, Laurain, Monthiers, Getsche, Versepuy, and Villiers for three years.

The Council announce their intention of publishing after the war a roll of honour of those in the gas industry who have fallen on the field of battle, or been honorably mentioned, wounded, &c. At present, this list reaches a total of 1142, of whom 488 have been killed in action or have died of wounds, 385 wounded, and 63 missing. The publication of a history of the Society from the time of its formation in 1874 has also been decided upon.

The report records the gratification of the Society at the more intimate association with the Institution of Gas Engineers, by whom the Society has been invited to send delegates to a conference to be held in London after the war, for the discussion of economic questions. In accordance with custom, Mr. A. E. Broadberry, M.Inst.C.E., the new President of the Institution, has been elected an honorary member of the Society.

Perhaps the most important matter touched on in the report relates to the work of the Commission appointed to consider provision for those wounded in the war in one or other of three ways: (1) Occupation in some new trade appropriate to their impaired physical condition and means of supplying the necessary technical training; (2) provision of artificial limbs; (3) monetary aid to those who have been rendered incapable of further work. This is recognized as an urgently needed scheme, and one which should meet with a full measure of support in proportion to the great sacrifices made by the heroic defenders of France.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Programme of the Annual General Meeting.

THE Fifty-Seventh Annual General Meeting of the German Association of Gas and Water Engineers will be held (as already announced) on Wednesday, the 28th inst., in the rooms of the Urania Society in Berlin. On account of the war, the proceedings will, as last year, be limited to a single day, and there will be no festivities.

The meeting will be opened by the President, Herr Hase, the Manager of the Gas, Electricity, and Water Works of Lubeck. After the opening speeches, the President will deliver an address on the "Influence of the War on the Gas Industry." There will then be a general discussion on "War Measures, War Experiences, &c." This will be followed by the reading of a paper by Dr. W. Salomon, the Director of the Geological Institute at Heidelberg University, on "The Supply and Use of Water in the Field." A paper will next be presented by Dr. R. Pintsch and Dr. Hübner, of Berlin, on "The Use of Coal Gas for Lighting Railway Carriages." The meeting will then receive and discuss the annual report of the Council and the accounts for the year, and settle the general programme for the ensuing year. The reports of the Technical Committees appointed by the Association will afterwards be presented and discussed; and the Council and members of Committees for the ensuing year will be elected.

PRODUCTION OF TOLUENE.

By D. R. WATTLEWORTH.

ONE of the most interesting problems at present before that section of the community whose business it is to distil coal, is how best to obtain a maximum output of toluene. To increase the supply of this important raw material, the "C" process has been introduced at a great many gas-works in the country; and though washing with tar is by no means an ideal method of recovering this hydrocarbon, yet the amount recovered in this manner must have materially added to our former production.

To recover the toluene present in town gas was the obvious way of increasing our production; but the problem has also been set about in a more scientific manner, and various schemes have been put forward to increase the amount of toluene actually produced in the distillation of coal. A great many of these schemes are merely blind guesses at what "might" happen if certain compounds are mixed with the coal, or certain conditions as to temperature, &c., observed during its carbonization. From published figures, the use of these so-called catalytic agents seems to have met with a certain measure of success; but what is their exact action is very doubtful indeed. Yet there must be some conditions in the retort or oven which govern the production of toluene. Some coals, distilled under standard conditions, yield more toluene than others; but our knowledge of the actual constitution of coal is so limited that at present we cannot look for much light to be thrown upon the subject from this quarter.

From an average English coal, it is usual to obtain about 1 gallon of benzene and about 1-5th of a gallon of toluene, when treated under ordinary gas-works or coke-oven conditions. That is, the ratio of the benzene to the toluene is about 5 : 1; and the ratio varies very little. Why should this be so? Why should not more methyl groups enter the benzene ring, and a greater proportion of toluene thus be formed? Is it because of an equilibrium being set up? What splendid opportunities for research are presented in these three queries! The formation of these aromatic compounds has already been the subject of much research and many theories; but nothing which can be of any practical help to us in our present position seems to have been brought to light.

One very popular theory is that these aromatic compounds are pyrogenetic products of acetylene. That acetylene does form aromatic compounds on being heated is readily shown by heating some acetylene over mercury, in a bent glass tube, up to a dark red hot. A reduction in volume takes place, and benzene, naphthalene, styrolene, retene, &c., are produced. In the presence of allylene, the next homologue of acetylene, methylated compounds—such as toluene, xylene, &c.—are also formed. Whether the aromatic compounds are actually produced in this manner, in the distillation of coal, is still a question, however, as some authorities assert that acetylene is not produced in the retort except at the highest temperature; while Lunge is responsible for the statement, "that at a lower temperature, less permanent gases and more methylated derivatives (toluene, xylene, higher phenols) are formed."

That, under present conditions, the question is entirely one of temperature is no doubt the case; but the possibilities of the action of substances added to the coal, or present as impurities, acting as catalytic agents, present a very wide field for research. It is more than possible that the experience already gained in connection with the many recovery plants now working, both of the "C" and oil-washing type, would, if collated, give us some valuable information upon this, at present, obscure subject. Figures showing the yield from the same class of coal, treated in various forms of retorts and in coke-ovens; with lime or limestone additions and without; results from coals containing chlorides, and from coals free from chlorides, and so on—all, if gathered together, would supply us with valuable data.

In the absence of an organized Intelligence Department, no better medium could perhaps be found for the pooling of such particulars than the pages of the "JOURNAL," where they would be open to all interested; and the valuable deductions of those most able to interpret the figures could be set out for the benefit of all gas men, and eventually for the country itself.

Calorific Valuation of Coal without a Calorimeter.—At the last meeting of the Society of Public Analysts, Mr. H. Procter Smith, F.C.S., read a paper on this subject. By means of Goutal's formula, the author showed how from the proximate analysis the calorific value of a fuel can be calculated—yielding results within the limits of experimental error of the calorific determination, and more trustworthy than many of the figures obtained with some of the cheaper types of instruments. From the figure thus obtained and the price of the fuel, keeping the different grades separate, a very reliable comparison can be made of the various fuels used, and their relative heating value. The methods for the proximate analysis were given, and a description of the mechanical condition of the fuel obtained by screening quantities of about 10 kilos. weight over 18-inch diameter sieves of various grades, thus giving additional information of value both to the user and seller of the coal.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Visit to Beckton.

The Spring Meeting of the Association was held last Thursday, when, on the invitation of the Governor and Directors of the Gas Light and Coke Company, members were enabled to visit the Beckton works.

Arriving about eleven o'clock, the party were received by Mr. Thomas Goulden, the Chief Engineer of the Company, and Mr. Lacey, the Resident Engineer.

The coal-unloading plant on the pier was first visited. The operations which were in progress showed how the cost of unloading is materially affected when unsuitable vessels have to be used for carrying the coal. In view of the congestion in the pitch market, it was an object of some interest to see a vessel at the pier loading-up a cargo of pitch.

A move was then made to two of the retort-houses. The contrast between these was most interesting, as the contents of one had quite recently been remodelled, while the other was waiting its turn. Thus the visitors were able to clearly contrast the new (which nearly doubles the productive power) with the old design. Special interest was shown in the neat, cheap, and effective method for handling the coke in the reconstructed house, and the ingenuity which has been displayed in introducing this into the original design of the house.

Visits were also paid to the carburetted water-gas plant, where conversation naturally turned to the prevailing high prices of oil. The machine-house in connection with the plant was, for its own sake, well worth the visit—containing within its fine structure much interesting and up-to-date machinery.

The next move brought the visitors to the toluol extraction plant, where it was at once apparent that the circular calling the meeting had properly referred to the "valuable and interesting work which is being done." The visitors showed their great interest by the numerous questions which were asked.

After brief inspections of a well-laid-out power-house containing electric generating plant driven by gas-engines of large power, and of a briquette-making plant in course of erection, a halt was called for a wash-up and lunch.

The visitors were received by Mr. H. J. Waterlow, the Deputy-Governor, and Mr. D. Milne Watson, the Managing-Director. Subsequently (after the toast of "The King" had been duly honoured) the Deputy-Governor, in an interesting speech, welcomed the Association. Beginning with an appreciative reference to the late Sir Corbet Woodall, he clearly showed the visitors what the Company were doing to help the country in her hour of need, and the great necessity which there is for all undertakings to do what they can.

Mr. W. Doig Gibb, the President of the Association, in reply, first referred to the great loss which the industry had sustained through the lamented death of Sir Corbet Woodall, and assured the Governor and Directors of the appreciation felt by the Association for the invitation given to them to visit Beckton and for the hospitality the members had received. Reference was also made to the kindness of the chief officials in making such complete arrangements for the comfort of the visitors. The Board of Trade "Calorific Value Bill" and some of its details were alluded to by Mr. Gibb. He also said he could not allow this, the first occasion upon which Mr. Milne Watson had appeared at a public meeting since his recent accession to the position of Managing-Director, to pass without asking him to accept the congratulations of the Association on the well-merited honour which had been shown to him.

Mr. Milne Watson, after thanking the Association for their congratulations, gave some valuable information and advice on the all-important coal question. He also referred to the advantage of Associations paying visits to works, as by this means much useful knowledge could be obtained and an opportunity afforded for informal discussions on various matters.

Mr. W. E. Price (the Hon. Secretary) proposed a vote of thanks to the officials whose influence had made the visit such a success—naming in particular in this connection Mr. Goulden, Mr. Lacey, and Mr. Thorman.

Mr. Goulden, replying to the vote, gave particulars respecting the gradual development of the Beckton works.

The visitors afterwards proceeded to the toluol rectification plant. This part of the visit was of particular interest, inasmuch as many of the members had not up till then had an opportunity of seeing any such plant at work. After the inspection of the plant was finished, the members returned to town with the united opinion that an extremely interesting and instructive day had been spent, although this gratification was combined with the sad thought that Sir Corbet Woodall (who from his sick bed at Torquay had made all the arrangements for the meeting) was no longer with them.

The meeting attracted so many members as to constitute a record—96 accepting the Company's invitation.

Midland Junior Gas Association.—There will be a meeting of the Association in Birmingham next Saturday, under the Presidency of Mr. F. J. Ward, of Knowle.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Motor Trip and Visit to the Garforth Gas-Works.

Though the circumstances of the time cause one to take part in a pleasure motor trip a little shamefacedly, it will be readily conceded that gas engineers, in view of the strenuous times through which they have passed and are passing, are justified in indulging, on an odd occasion, in the use of precious petrol for such a purpose—particularly when one of the aims in view is, as was the case with the Yorkshire Junior Gas Association, to revivify the organization to the greater benefit of an industry which is so important to the nation. The demands of war for men and material have, in recent times, affected the Yorkshire Junior Gas Association as most other peace-time organizations—particularly of men who have become direct war workers—have been affected. The need of a somewhat violent stimulant was becoming seriously evident; and the generosity and patriotism to the industry on the part of Mr. John Demain, the President of the Association, and of the Directors of the Garforth Gas Company, provided that stimulant at the right moment, by their acting as hosts at Saturday's "Joy Day."

The motor trip on Saturday afternoon was by far the most successful affair of a social nature which the Association has ever enjoyed, and on all hands were expressed congratulations to Mr. Demain and his Directors upon the event.

The party, numbering close upon 80, included Mr. R. S. Balden (Chairman of the Garforth Gas Company), and Messrs. J. W. W. Waterhouse and G. W. Lupton, Directors, Mr. Demain and Mr. E. Garsed, the President and Secretary of the Association, and four ladies.

The drive, starting from Leeds, was by way of Chapletown, Harewood, Spacey Houses, Harrogate (where there was half an hour's stay), and Wetherby, to Boston Spa; the journey being through charming country. High tea was served at the Royal Hotel, Boston, after which the visitors had half an hour in which to wander about. The return journey was by way of Tadcaster, Bramham, Aberford, and Garforth, to Leeds, where all arrived about ten o'clock, in time to catch trains for their respective home towns.

The Garforth Gas Company's Hospitality.

After the meal at Boston, over which Mr. Waterhouse presided—Mr. Balden having been called away on urgent business—the visitors were given a hearty welcome to the pleasures of the day. Mr. Waterhouse said he and his fellow Directors were gratified to see so large an attendance; and it would be a great encouragement to Mr. Demain, the President. He only hoped this gathering was a sign of the determination of engineers to further, by their efforts and loyalty, the progress of the gas industry. He was perhaps a bit biassed, because he was interested in several gas companies; but he did hope they would all do their part in "downing" the competition of electricity by aspiring constantly to the further improvement of gas. Whatever he could do to this end was a pleasure to him; and he hoped they would all work to make the gas industry as highly successful as was that day's pleasure.

Mr. E. H. Hudson (Normanton), the representative of the Manchester Institution on the Council of the Association, proposed a vote of thanks to the Directors of the Garforth Gas Company and to Mr. Demain. It was plain to be seen that everybody was, that day, perfectly happy. He hoped that the Directors would fully appreciate—as did the members of the Association—what a service they had done the Association in encouraging it in this way. It was to the future that the young men of the profession must look and fortify themselves by means of such an Association as this one. The gas organizations of the country were giving the young men opportunities of meeting and comparing experiences. Some of the papers which were read at the meetings of the Yorkshire Juniors would do credit to the Seniors—in fact, a Junior paper had taken one of the London medals. Any encouragement to the Juniors was money well spent by any board of directors. The Garforth Company did not directly benefit; but the profession would do so as a whole, and this must ultimately reflect on the Garforth concern as on others.

Mr. Charles Roper (Bradford), in seconding the vote of thanks, said a relaxation from their hard labours of the present time had been particularly welcomed. The attendance amply showed the members' appreciation of the generosity.

The motion was carried with acclamation.

Mr. Waterhouse briefly responded.

Mr. Demain took the opportunity to appeal for more support for the Association in the way of the provision of papers by the younger members. Papers, of course, took a good deal of preparing, and members individually must find difficulty in hitting upon a subject upon which to specifically speak. In such cases the Association would welcome collaboration between a group of two or three members who, among them, should be able to produce something of interest and value. They should remember, too, that it was their bounden duty to join in the discussions on papers. It sometimes happened that a paper gave rise to a discussion which drew forth even more valuable and new points than the paper itself had done. It was surprising what a mass of information there was which nobody thought worth passing on, and yet which was new and helpful to others if it were brought out.

Visit to the Garforth Gas-Works.

At Garforth, the party were conducted by Mr. Demain over the works under his control. The deepest interest was evinced in the tiny plant. The whole of it, including the Manager's house and allotments of vegetable garden, &c., for Mr. Demain and for the

workmen, in spare space, occupies an acre. The plant is high pressure, and by 4-inch mains supplies Garforth, Aberford, and Barwick-in-Elmet. The works have a yield of 18 million cubic feet per year. When Mr. Demain first went there the make was only 6 millions. The pressure is sent up to a third of a pound, but at will may be increased to 5 lbs. The plant is driven by gas-engine, though there are also a steam boiler and engine, which are rarely used. There are three beds of six retorts. The retort-house is whitewashed twice a year, and the result is considered well worth it. The yield of liquor is up to 32 gallons (10 oz.) per ton of coal; the highest yield having been 32½ gallons. There have recently been more alterations of arrangements in most departments, and new purifiers have been put in. When these have been coupled-up and running for a little while, a new oxide shed is to be built. The visitors were shown three new houses built for workmen. The whole plant was an example of compactness and utilization of ground space. The works are situate alongside the main North-Eastern Railway line.

ISLE OF WIGHT GAS ASSOCIATION.

The Twelfth Annual Meeting of the Association was held at the Ryde Gas-Works, last Saturday week—Mr. F. F. Farrand (of Ryde) in the chair.

Mr. Ernest Groves, J.P. (the Chairman of the Ryde Gas Company), welcomed the members. He referred to the trying times all managers of gas-works are passing through. Reference was made to toluene and benzol extraction being carried out by gas companies; and he paid a warm tribute of appreciation to the work being done by the Association.

In the report of the Management Committee, allusion was made to the lamented death of the Hon. Secretary and Treasurer of the Association (Mr. E. H. Millard), who had held the position since the inception of the Association.

Mr. Robert Fish (East Cowes) was elected Chairman for the present year, and Mr. J. S. Ineson (Ventnor) Deputy-Chairman. Mr. S. W. Ibbotson (Newport) was elected Hon. Secretary and Treasurer, and Mr. W. Halliday Auditor. A donation of £3 3s. was given to the Benevolent Fund of the Institution of Gas Engineers; and a vote of thanks was passed to Mr. Farrand, who had been Chairman during the past year.

After inspecting the works, high tea was served; and the usual votes of thanks closed the proceedings.

ESTIMATION OF BENZENE AND TOLUENE IN COMMERCIAL MIXTURES.

By A. Edwards.

[A Paper presented at the Meeting of the Yorkshire Section of the Society of Chemical Industry.]

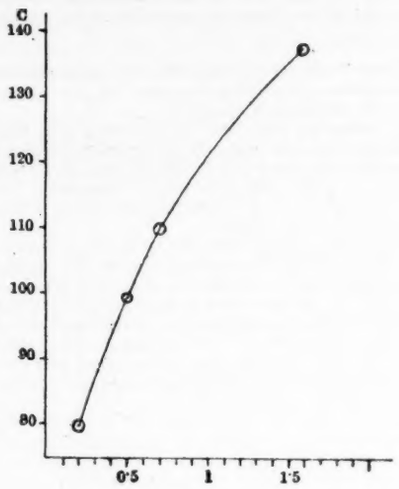
The initial call for toluene for the manufacture of explosives led to its evaluation by a simple method devised by Dr. Colman. The limiting of its use to material containing between 50 and 75 per cent. of toluene rendered this method unwieldy for general application to very varying ranges, since the errors of the determination are multiplied according to the necessity for the dilution with pure toluene, benzene, or xylene. Moreover, the supply of pure hydrocarbon is an item when many analyses are made.

It occurred to me that if the constituents of naphtha could be isolated readily in pairs, use could be made of the boiling point composition curves of each pair—namely, benzene-toluene and toluene-xylene. The curves function throughout the whole range of mixtures possible; and they have the advantage that they may be deduced from the vapour pressures of each constituent if necessary. I am greatly indebted to a work on "Fractional Distillation" by Professor Sidney Young, from which calculated data for the molecular composition-boiling point curve of benzene and toluene were obtained. The volume composition boiling points were deduced therefrom, and subsequently the curve was checked by mixtures of the pure constituents. The new curve given was found to fall slightly lower—the maximum deviation being 0·2° C. The curve for toluene and xylene given was similarly constructed from known admixtures of the pure constituents.

Conversation with other chemists discloses the fact that considerable discrepancies are found between the returns for toluene content obtained by themselves, and by the official chemists, using the Colman method. A discussion of the differences is desirable, since any method of analysis proposed may suffer like vagaries from the same causes.

The obvious errors of graduated cylinders may be satisfactorily checked against standard burettes. But the greatest source of error lies in the thermometer. It is to discrepancies in the scale readings and varying stem immersion that the bulk of the differences between the results of one operator and another are to be attributed. Minor discrepancies may be introduced by failure to dry the distillates, and failure to apportion correctly the loss on distillation.

For the purpose of checking the thermometer, and constructing the boiling point composition curves, quantities of reputedly pure benzene, toluene, and xylene were taken and refractionated through a column; the products collecting within a variation of 0·2° C. being accepted as pure, and assigned the values of: Benzene, 80·2° C.; toluene, 110·70° C.; xylene, 139° C.—at 760 mm. barometric pressure. The thermometers were then all checked at the boiling points of each hydrocarbon and in steam—all at 760 mm. pressure; and any variation from the above values was



plotted against the scale readings. The curve appended gives the result for one of the best thermometers examined. In the construction of the boiling point composition curves, the scale readings at all points have been corrected by the indication of this thermometer curve. The variation of boiling point for changes of barometric pressure is 0·47° C. for every 10 mm. of mercury, and is approximately the same for the three hydrocarbons.

Every thermometer used for the estimation of toluene and benzene by any method involving distillation should be checked as above, and due allowance made for the height of the barometer at the time the estimation is conducted.

Separation into Distillates of Two Components.

The separation is made by distillation through a Young twelve-bulb column, dividing the range 80·2° to 139° C. into four parts, with refractionation of the two middle portions. The presence of carbon bisulphide and low boiling paraffins ("forerunnings") necessitates an additional separation to 80·2° C. The scheme varies with the character of the material, and is fully set forth under the sub-title "Crude Benzol." The mixture may be fractionated in the manner described by James [see "Journal" for March 7 last, p. 531]. The fractions are dried by plaster of Paris, and the boiling points taken.

Boiling Point of Fractions.

In ascertaining the boiling point of the fractions, it is necessary to keep the composition of the liquid phase constant throughout the determination. The apparatus illustrated in fig. 1 consists of a wide-mouth flask fitted with a cork carrying a reflux condenser and a short length of ½-inch diameter glass tubing reaching to a point just clear of the bottom of the flask. A thermometer is inserted in the tube, so that its bulb is ¼ inch from the surface of the liquid. A hole is blown in the tube just below the bottom of

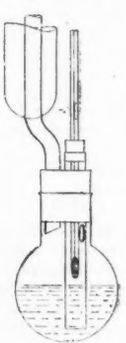


Fig. 1.

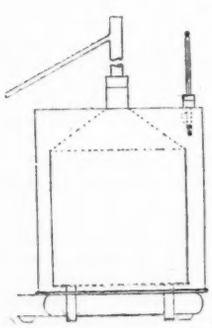


Fig. 2.

the cork to allow the vapour to circulate. The capacity of the bulb should be such that the liquid fills about one-half of it. From 50 to 120 c.c. is a suitable volume. The liquid is caused to boil-up the tube and over the bulb of the thermometer until the temperature is constant. The flame is then shifted slightly to one side, so that ebullition takes place outside the tube—the temperature again being read when constant. This temperature

is corrected by the thermometer curve and for the barometric pressure. Reference to the boiling point composition curve discloses the proportion of each constituent present.

Application to Commercial Fractions.

The method has been of great use in the control of stills for the production of rectified benzol and toluol. The washed "once run" benzol, toluol, or solvent is fractionated as outlined elsewhere, and the composition read from the curves. The yield of products closely follows the amounts indicated by analysis. One is able to give the still-man a dip to which he can quite safely go in his storage tank before reaching the cut-point for the next constituent.

The working of the stills may be closely followed by applying the boiling point determination to the runnings direct, without refractionation, since the working columns themselves are sufficiently efficient to pass only admixtures of two constituents—either benzene *plus* toluene or toluene *plus* xylene.

Crude Benzol.

In the analysis of crudes containing creosote, it is necessary to rectify to 180° C. through a column, followed by a second fractionation of the distillate to 145° C. The product is washed with acid and alkali, dried, and fractionated to 139° C. In this distillate there is usually a considerable proportion of forerunnings present boiling below 80·2° C. These must be removed; otherwise the boiling point of the benzene *plus* toluene fraction would be lowered, and indicate a deficiency of toluene. The scheme of four fractions is extended to include one for forerunnings. We then have:

1. Up to	85° C.
2. 85° to	96° C.
3. 96° to	110·7° C.
4. 110·7° to	125° C.
5. Residue at	125° C.

All the fractions except the second and fifth are refractionated. From No. 1 all that comes over to 80·2° C. is collected separately; the residue goes to No. 2. Nos. 3 and 4 are fractionated to 110·7° C.; the distillates going to No. 2 and the residues to No. 5. The boiling points of Nos. 2 and 5 are then taken; the proportion of the forerunnings collected separately is added to the benzene indicated by the curve. The toluene indicated will be exact; but the benzene will be impure according to the quantity of forerunnings present.

Rectified Benzol.

The presence of forerunnings in rectified benzol renders the composition somewhat uncertain, as with crude benzol. By rectification to 80·2° C., allowing the thermometer to dwell on this point for a few moments, followed by a re-distillation of the distillate to 80·2° C., they may be separated, and the true composition of the residue found from the boiling point composition curve. The proportion of toluene is indicated correctly; but the true proportion of benzene cannot be ascertained until the identity of the forerunnings is established. After treatment for the removal of carbon bisulphide, these forerunnings have a specific gravity of ·864 to ·885 with a boiling point of 72° to 73° C. The low boiling point is certainly not due to the presence of members of the C_nH_{2n+2} series of hydrocarbons exclusively.

Rectified Toluol.

Separation into four fractions with refractionation of the second and third is sufficient.

Rectified Solvent Naphtha.

It is necessary in these days to know the proportion of toluene present before submitting it for sale. A preliminary rectification to 145° C., followed by a rectification of the distillate to 139° C. and a direct determination of the boiling point of the second distillate is sufficient.

Experimental Gas Washings—Rich Oil.

A preliminary distillation without a column is made to 230° C. The distillate is treated like crude benzol.

Tar.

The tar is distilled in a copper cylindrical still to 230° C., and the distillate treated like crude benzol. The technical difficulty met with in distilling tar, due to the presence of water, may be overcome by jacketing the still, as indicated in fig. 2—leaving a few holes in the top of the jacket for the escape of products of combustion. The details of the still and jacket are: Still, 8 inches diameter, 8 inches high to the dome; neck, 1¼ inches diameter by 1¼ inches long, of solid drawn copper tubing; all joints brazed. Jacket of sheet tin, 10 inches diameter by 11½ inches high; top punched with 1¼ inch diameter hole to take the neck of the still, and with six ⅜-inch holes evenly spaced 3 inches from the centre; three springs at the base projecting inwards 1 inch, to act as distance-pieces by bearing on the side of the still. The still is supported 1 inch above the top of a Fletcher triple concentric ring-burner by a four-legged stand.

The distillation is started with the outer ring only burning. The products of combustion pass up the jacketed space, and do not directly heat the bottom of the still. A thermometer in the jacket may indicate 230° C. with a rich tar containing up to 5 per cent. of water, without danger; the light oil and steam leave the still head at 105° to 110° C. Distillation is allowed to proceed until the still head temperature begins to rise, and the distillate slackens, when the inner rings of the burner may be started and the outer one closed down. A very bad tar containing a small quantity of light oil and much free carbon may require a temperature of 150° C. in the jacket (still head 100° to 103° C.) until most of the water has been driven off. It is an advantage to work with a long still head—say, 10 inches from the side tube to the top of the cork. Should the jacket be too hot and the contents of the still froth-up into the head, the burner may be promptly turned out before the tar reaches the side tube, and a slightly lower temperature tried in the jacket after the tar has subsided. Condensation need not be feared since the vapours are superheated.

The boiling point composition curves may be constructed by using the above figures.

Boiling Points of Mixtures of Toluene with Benzene and Xylene.

Toluene. Per Cent. by Volume.	Boiling Points, ° C.	
	Benzene and Toluene.	Xylene and Toluene.
	Degrees.	Degrees.
0	80·2	139
10	81·8	134·4
20	83·7	130·3
30	85·75	126·7
40	88·1	123·5
50	90·75	120·8
60	93·8	118·4
70	97·2	116·3
80	101·0	114·3
90	105·3	112·5
100	110·7	110·7

COMPRESSIBILITY OF NATURAL GAS AT HIGH PRESSURES.

In the course of its examination of samples of natural gas from many different gas-fields through the country, the United States Bureau of Mines has conducted various special researches in order to ascertain with exactness the composition or physical properties of certain of the samples or to determine the bearing of the facts upon larger problems involved in the transportation and the use of the gas. A Bureau "Technical Paper"—No. 131, published in February—treats of an investigation of the compressibility (at pressures up to 35·5 atmospheres) of natural gas supplied to Pittsburgh, and points out the bearing of the results on the measurement of natural gas at high pressures.

The natural gas used at Pittsburgh is found to contain 84 per cent. of methane. The compressibility of methane has been determined by Amagat from pressures of 39 to 290 atmospheres. From 39 atmospheres (his lowest observation) to 1 atmosphere, approximate values have been derived by extrapolation. Methane is about 9 per cent. more compressible at 40 atmospheres, and about 17 per cent. more compressible at 100 atmospheres, than at 1 atmosphere. The compressibility of the gaseous constituents of natural gas—such as ethane, propane, and butane—has not been determined. These constituents deviate more from Boyle's law than does methane, and hence make natural gas more compressible than if it consisted of methane alone. The compressibility of the natural gas of Pittsburgh is shown by manometer tests to differ from that of an ideal gas by as much as 15 per cent. at a pressure of 35·5 atmospheres.

The results are of practical value because, in measuring natural gas, it is the practice to assume that the product of the pressure by the volume is a constant. As to the application of these results, it may be noted that sometimes natural gas is measured at pressures as high as 40 atmospheres, and that many millions of cubic feet are measured at pressures of 20 to 30 atmospheres. In computing the volume of gas, the assumption is always made that Boyle's law applies—that is, that the product of pressure and volume is constant at all pressures. Hence, in measurements under high pressure, the error introduced is of great magnitude. For instance, suppose 100 million cubic feet of gas a day are measured at 375 lbs. According to the tests, the gas is 11 per cent. more compressible at 375 lbs. than at atmospheric pressure. This means that each day 11 million more cubic feet of gas are measured than are supposed. If no correction is applied in measuring the gas, a distributing company that buys natural gas at high pressure and sells it at low pressure may sell much more gas than it pays for.

Vertical Retorts for Rochester (U.S.A.).

When quoting on p. 506 of the "Journal" for the 6th inst. some particulars from the Chicago "Gas Record" regarding a new vertical retort installation for the gas-works at Rochester (U.S.A.), we were misled, by adopting our contemporary's heading, into calling it a "Dessau" plant. This is incorrect. The installation is of the United Gas Improvement Company's own design, and embodies many of their important patents and improvements developed in their construction of vertical coal-gas plants throughout the United States.

COAL TAR AND AMMONIA.

By Professor THOMAS GRAY, D.Sc., Ph.D., of the Royal Technical College, Glasgow.

A Lecture on the "Bye-Products of the Gas Industry, with Special Reference to Coal Tar and Ammonia," delivered to the Waverley Association of Gas Managers. June 9.]

At the present time, when the resources of the coal-distilling industries of the world are being taxed to their full capacity to provide raw material for the manufacture of explosives, and processes for the complete extraction of the lighter hydrocarbons from coal gas, or for enriching tar with the latter, are in operation in the majority of the gas-works of the United Kingdom, the choice of the subject of an address offers no difficulty—interest at the moment centres principally round coal tar and the products which result from its distillation. But, while these afford more than ample material for a single lecture, I have given preference to the wider title, so that I may have the opportunity to refer shortly to ammonia, and to discuss the situation which will arise when the increased output of these materials, which has been stimulated by the war, is once more diverted into the normal peace channels. I make no claim of novelty, as the time available for the preparation of this address has been too limited to permit me to carry out any experimental work; but I may express the hope that a concise statement of the current views regarding the formation of the bye-products referred to, and of the present and possible applications of these materials, may prove useful as a basis for discussion, and as an indication of possible lines of experimental inquiry.

FORMATION OF AMMONIA.

Coal contains from 1 to 2 per cent. of nitrogen in the form of nitrogenous organic matter, regarding which little more is known than the fact that it undergoes decomposition under the influence of heat, with formation of ammonia. An average British coal may be assumed to contain approximately 1·4 per cent. of nitrogen; and such a coal would yield the equivalent of 148 lbs. of ammonium sulphate, if it were possible to convert the whole of the nitrogen into ammonia. The actual yield under practical working conditions falls far short of this theoretical maximum, and varies greatly according to the character of the coal and the temperature and duration of heating. While coals rich in nitrogen give, generally speaking, the largest yields of ammonia, there does not appear to be any connection between the nitrogen content and the amount of ammonia produced; but it has been proved that the more recently-formed coals decompose at a lower temperature than the older coals, and that they give a larger proportion of their nitrogen in the form of ammonia.

According to Anderson and Roberts, the temperature at which evolution of ammonia begins ranges from 350° C. (662° Fahr.), in the case of the younger coals, to 480° C. (896° Fahr.) for anthracites. But experience of carbonizing coal on a large scale shows that much higher temperatures are necessary for the production of the maximum yield of ammonia. Thus Lewes reports that the weight of ammonium sulphate obtained in the "Coalite" process averaged only 12 lbs. per ton of coal carbonized at 420° C. (786° Fahr.); whereas the maximum yield in a horizontal retort is stated to correspond with a gas make of 9500 cubic feet and a temperature between 800° and 900° C. (1470° and 1650° Fahr.) As the temperature of carbonization is raised beyond these limits, the ammonia yield falls steadily. This finds an explanation in the results of the experiments of Ramsay and Young, who report that ammonia begins to decompose somewhere in the neighbourhood of 500° C., and that it is practically completely decomposed into its constituents, nitrogen and hydrogen, if subjected to prolonged contact at 780° C. with suitable heated surfaces, such as asbestos and iron. Though the effects of carbon and fire-clay were not investigated, it is probable that prolonged exposure to contact with these materials at 800° C. would destroy the ammonia equally effectively; and, at first sight, it would appear difficult to explain the survival of the ammonia in the retorts. But this difficulty disappears when the conditions are studied more closely.

In the earlier stages of carbonization, the ammonia is accompanied by relatively large volumes of tar vapours and steam. The former, in the course of their passage through the retort, are largely decomposed, with formation of secondary products, such as the hydrocarbons of the benzene series, naphthalene, free carbon, pitch, and permanent gases. The formation of these new products involves an absorption of heat, thus exercising a cooling effect on the inner walls of the retort, which is further intensified by the high specific heat of the steam. The mere dilution with steam, tar vapours, and permanent gas also affords an additional protection to the ammonia, as actual contact of the particles of the latter with the heated surfaces is thereby minimized. It is only towards the end of the carbonization period, when the temperature of the charge is approaching that of the retort, that the conditions necessary for the more or less complete decomposition of the ammonia prevail; and at this stage the evolution of ammonia from the retort practically ceases.

When considering the effect of temperature, it is important that the influence of the mass of coal in the retort should not be lost sight of, since this will determine the internal temperature during a considerable portion of the carbonization period. Christie showed that gradual heating gives an increased yield of ammonia; and, as a conclusion from his experiments, we may assume that carbonization in bulk, as practised in the manufacture of coke, will yield a larger proportion of the total nitrogen of the coal in the form of ammonia. This inference appears to be justified by practical results, though the high yields of ammonia—up to 36 lbs. per ton of coal carbonized—so far as they are not explained by a high nitrogen content of the coal, are probably greatly due to the influence of the relatively large proportion of water in the washed coal.

The distribution of nitrogen among the products of distillation has been the subject of a considerable amount of experiment, which cannot be discussed here in detail; but reference may be made to the extensive series of tests by Macleod, who examined the products of distillation from eighty different coals, which were carbonized in horizontal retorts under ordinary working conditions. His average results show that of the original nitrogen in the coal 17·1 per cent. was recovered in the form of ammonia, 1·2 per cent. as cyanogen, 3·9 per cent. as nitrogenous substances in the tar, and 19·5 per cent. as free nitrogen in the gas; whereas from 30·2 to 89·6 per cent. (average, 58·3 per cent.) remained behind in the coke. A noteworthy feature of these, as well as of the original experiments of Foster and succeeding workers, is the large proportion of nitrogen retained by the coke—amounting, roughly, to one-half of the original nitrogen in the coal. Various attempts have been made to recover this. In 1883, Tervet showed that ammonia was formed when hydrogen was passed through the red-hot coke which remained after the volatile matter had been expelled from coal at a red heat; and, under favourable conditions, he succeeded in getting the equivalent of 57 lbs. of ammonium sulphate per ton of coal. His results were subsequently confirmed by Beilby, who proved the possibility of recovering about 70 per cent. of the total nitrogen in coal by gasification of the latter with air mixed with a large excess of steam, and thus anticipated in actual working practice the method of producing power gas which was subsequently developed by Mond, by means of which 70 to 90 lbs. of ammonium sulphate are regularly produced per ton of coal gasified.

Since the Tervet reaction proceeds comparatively slowly, there is little prospect that the introduction of hydrogen (or water gas, which the discoverer found to have a similar action) into the horizontal retort at the end of the carbonization period, for the purpose of recovering a portion of the residual nitrogen, would prove remunerative. But the suggestion of the late Professor Lewes, that an increased yield of ammonia would result from the admission of a regulated current of water gas at the bottom of the modern vertical retort, appears to be well worthy of serious experimental trial. The use of steam—involving, as it does, the gasification of the coke—is obviously not applicable to gas-works practice, in which coke is produced as a bye-product.

The reactions just referred to, while they have not yet been directly employed in gas-works for the purpose of increasing the ammonia yield, nevertheless play a very important part during the carbonization of coal. The ammonia which is formed during the earlier stages of the distillation is evidently a primary product; but, as the heat penetrates the charge, water still present in the interior is vaporized, and, along with the water vapour which results from the decomposition of the coal, passes through the highly heated, more or less completely carbonized, outer skin, and is partly decomposed by the carbon, with formation of carbon monoxide and dioxide, while the hydrogen liberated from the water unites with the nitrogen of the coke to form ammonia. At a later stage of the carbonization, when hydrogen is being evolved freely, the Tervet reaction comes into play, and continues throughout the remainder of the period, though the ammonia which is formed towards the end of the process is probably largely decomposed during its passage through the retort. The increased yield of ammonia at high carbonization temperatures is attributed to these secondary reactions, and principally to the action of hydrogen.

The yield of ammonia in the different systems of carbonization, expressed in terms of sulphate, ranges from about 20 to 36 lbs., and from coal distilled in horizontal retorts is usually 24 to 26 lbs. In the present state of our knowledge of the subject, there is nothing to indicate a prospect of any substantial improvement of the ammonia yield; but a similar criticism of the still prevalent system of recovering this product from the gas, which involves the handling and storage of large volumes of liquor, with the attendant unavoidable loss of ammonia and the transport (often to considerable distances) of a dilute liquor containing only 2 per cent. of valuable material, can scarcely be justified. A more general adoption of the semi-direct process of recovering ammonia from the gas in the form now practised in some of the smaller gas-works, is desirable; and the proposal to combine a direct system of ammonia recovery with arrangements for the fractional condensation of the tar on the lines suggested by Purves,* appears to me to call for the serious consideration of the gas engineer.

AMMONIA OUTPUT.

The world's output of ammonia, expressed in metric tons of sulphate, and those of the three principal producing countries are represented in fig. 1, along with average yearly prices per ton f.a.s. Glasgow, based on actual sales. It will be noticed that the position previously held by Great Britain as the largest producer has been occupied by Germany since 1910, though as an exporter the

* See "JOURNAL," Vol. CXXX., p. 199.

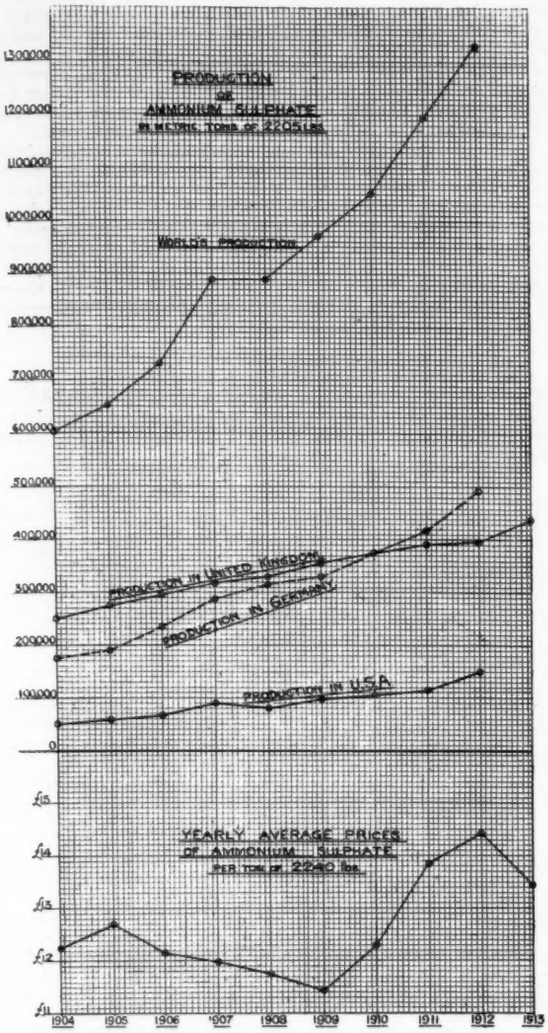


Fig. 1.—Production and Prices of Sulphate of Ammonia.

former still holds the leading position. The steady increase of the output is very largely due to the development of bye-product recovery in coke manufacture, with which industry the bulk of the production is associated in all the producing countries, with the single exception of Great Britain, where the largest share is still provided by the coal-gas industry, as is shown in the following statement, taken from the report of the Chief Inspector of Alkali Works:

Tons of Ammonia (expressed as Sulphate) Recovered in the United Kingdom.

	1913.		1914.
Gas-works	182,180	..	175,930
Iron-works	19,956	..	16,008
Shale-works	63,061	..	62,749
Coke-oven works	133,816	..	137,430
Producer-gas and carbonizing works	33,605	..	34,295
Total	432,618	..	426,412

A fact of special interest, which is illustrated by the diagram referred to, is the appreciation in value of ammonium sulphate, in spite of a rapidly increasing production. This is explained by the remarkable development of the employment of ammonium sulphate as a fertilizer during the period under discussion. The consumption in Germany, for example, rose from 240,000 metric tons in 1907, to 425,000 tons in 1912; that of Japan from 69,600 to 94,000 tons during the same period; while the consumption in the United States of America, which amounted in 1903 to 53,200 metric tons, increased to 210,400 tons in 1912. All the ammonia producing countries, except Germany and Great Britain, consume more sulphate than they produce; and even in Germany the balance available for export has hitherto been relatively small, as is evident from a glance at the diagram and figures already quoted. In Great Britain, on the other hand, the home consumption for all purposes, including manure manufacture, has remained at a comparatively low level, fluctuating between 85,500 and 97,000 tons per annum during the years 1910 to 1913 inclusive. The export of ammonium sulphate from the United Kingdom during 1913 amounted to 323,000 tons, of which total Japan absorbed rather over one-third. The expansion of the export to Japan from 1290 tons in 1901 to 114,583 tons in 1913 is particularly striking.

A study of these figures leads to the conclusion that the world's capacity for ammonium sulphate is still far from being satisfied, and that the consumption will keep pace with supply so long as the latter is entirely associated with the coal-distilling industries, which place a limit to the production. There may be periods of over-production, due to a rapid development of bye-product recovery in the manufacture of coke; but such an expansion of the output in this connection is only to be anticipated in the United States. There the conditions for the extension of bye-product recovery are less favourable than in Europe, where coal-tar pitch—in normal times the most valuable portion of the tar—finds a ready market for briquetting coal and for street-paving; whereas in the United States there is practically no demand for briquetted coal, on account of the abundant supply of bituminous coal, and for street-paving the asphaltic residues from the distillation of the heavier petroleums provide an efficient substitute. In spite of the relatively low value of coal tar, the erection of bye-product coke-ovens was proceeding rapidly in the United States during the years prior to the European war; and the development has since been greatly stimulated by the unprecedented prices for benzene and toluene.

It is useless to speculate regarding the effect of the increased American production after the war, since this will depend on the fate of the coking installations in the French and Belgian territory at present in German occupation. But even if these remain intact, it is probable, in view of the present comparatively low consumption, that the United States will ultimately absorb all the ammonium sulphate they are capable of producing as a bye-product of the local coke industry. In this connection, the following statement of the consumption of ammonium sulphate per acre of cultivated land is of special interest: Belgium, 17·83; Germany, 9·88; United Kingdom, 5·35; France, 2·23; United States, 1·34 lbs.

Synthetic Ammonia.

A discussion of this question would be incomplete without some reference to the possible influence of synthetic ammonia. Considerations of time prevent me from giving a detailed statement of the various methods which have been suggested, and attention will therefore be confined to Haber's process—the only one which so far has given promise of commercial success. Haber and his fellow-workers, in the course of a long and exhaustive experimental inquiry into the conditions under which hydrogen combines with nitrogen, have succeeded in preparing mixtures of gases containing from 2 up to 18 per cent. of ammonia, by passing mixtures of nitrogen and hydrogen, at pressures varying from 120 to 200 atmospheres, through pipes containing catalysts—such as uranium and osmium—heated to temperatures ranging from 500° to 700° C. High pressures and temperatures were found to favour the rate of combination of the nitrogen with the hydrogen; but the yield of ammonia at the higher temperatures was low. A better yield was obtained at the lower temperature; but the rate of combination was found to decrease rapidly with a falling temperature. The nature of the catalyst, also, had a very important influence on the velocity of the reaction. The ammonia which is formed may be easily separated in the liquid form by cooling the gases; and the unchanged mixture of nitrogen and hydrogen is returned to the reaction chamber for further treatment.

Hydrogen may be obtained by the electrolysis of water, by the action of steam on iron, or from water gas; and it is also produced in large quantities in the electrolytic manufacture of alkali. The nitrogen is preferably prepared from air by liquefaction and subsequent fractional distillation of the liquid. The raw materials for this process are thus available from air and water in practically inexhaustible quantities; and this constitutes the chief element of danger to the coal-distilling industries, since there is no limit to the possible production.

Plant for the manufacture of ammonia on a large scale by Haber's method was in course of erection in Germany at the outbreak of the war; but no information regarding this is yet available.* It is safe to predict, however, that the development of this process, if it proves to be a commercial success, will not render the recovery of ammonia in connection with existing coal-distilling plants unremunerative, though it will undoubtedly have a very serious influence on prices. In view of this possibility, the need for an inquiry into existing methods of dealing with ammonia as a bye-product of the manufacture of gas, for the purpose of determining the best methods of preventing loss and of reducing the cost of converting it into sulphate, is urgent.

Coal Tar.

Turning to the question of coal tar, the lecturer explained that the yield and character of tar are subject to very great variation, according to the nature of the coal and the temperature to which it has been subjected during distillation; and he added that the yield of tar rises with an increasing percentage of oxygen in the coal, up to nearly 12 per cent. of oxygen, if the hydrogen in the coal exceeds 5 per cent., and that coals containing 10 to 11 per cent. of oxygen and more than 5 per cent. of hydrogen give high yields of tar rich in heavy hydrocarbons [Lewes]. Particulars were given with reference to the composition of low-temperature,

* Some reference to the Haber process will be found in an article appearing in a recent issue of the "Frankfurter Handelsblatt," a translation of which appears on p. 654 of this issue.—Ed. J.G.L.

horizontal retort, and vertical retort tars; the remark being made, in reference to the first named, that experimental trials, for the purpose of ascertaining the fuel values of the heavier oils, and a detailed examination of the low-temperature tar from the scientific standpoint, are desirable.

Output of Tar.

Professor Gray stated that the total output of tar in the United Kingdom is approximately 1½ million tons, made up as follows:

	Tons of Tar Produced.
Gas-works	850,000 to 900,000
Coke-works	400,000 to 450,000
Blast-furnaces	140,000
Gas-producers	30,000

Vertical-Retort Tar.

In giving an account of the process of distillation of coal tar, the lecturer said that, if the hydrocarbons of the benzene series are mixed with paraffins and naphthenes, as is the case with the light oil from vertical-retort tar, the production of satisfactory pure products by distillation, or by any known commercial process, becomes difficult, and even impossible if the contamination is serious. The boiling-points of the paraffins and naphthenes cover the whole range of temperature; and some have values intermediate between those of benzene, toluene, and xylene. As a consequence, the intermediate fractions, in place of being relatively small, are large. And, since they contain paraffins, they cannot be returned to the process, with the result that the benzene hydrocarbons they contain are not recovered. And not only are the principal benzene and toluene fractions smaller in quantity, but they are also less pure, and betray the presence of paraffins by their low specific gravity, even when they boil within the specific range of temperature.

If the proportion of paraffins in so-called pure benzene and toluene is considerable, they are rendered unsuitable for the manufacture of pure chemicals and explosives, for reasons which cannot be entered into here. The difficulty introduced by the presence of paraffins is not serious if commercial products only are made. In normal times, the bulk of the production reaches the market in the form of less closely fractionated mixtures, which are sold under the names of 90 per cent. benzol and 90 per cent. toluol—which terms are intended to convey the information that 90 per cent. by volume passes over below 100° C. in the first case, and below 120° C. in the case of the second-named product. For most purposes to which these are applied in practice, the presence of paraffins, unless they occur in large proportions, is not material.

This difficulty has been referred to at some length, since it affects the value of tar for the preparation of pure chemicals; and the distiller—particularly at the present time—is inclined to regard vertical-retort tar with considerable disfavour.

Benzene and Toluene.

Proceeding, Professor Gray said that the proportions of benzene and toluene in the tar depend, not only on the character of the coal and the temperature of carbonization, but they are also influenced to a marked degree by the rate of condensation of the products. Slow cooling of the tar vapours favours fractional condensation, with the result that the portion of the tar which is carried forward to the condensers is rich in the lighter hydrocarbons, and the gas leaving after contact with these consequently carries with it a larger proportion of the total benzene and toluene, leaving a tar correspondingly poorer. It is now well known that a large proportion of volatile hydrocarbons may be removed from the gas by washing it with the whole make of cold crude tar; and rapid condensation of the tar vapours has a similar action, though it is naturally less effective. It is therefore not surprising that individual samples of tar show great variations as regards their benzene and toluene contents. In crude tar, the benzene usually varies between 0·5 and 1 per cent., though it may be considerably higher; and the toluene generally ranges from 0·1 to 0·5 per cent. On account of the widely varying results and the uncertainty regarding the representative character of some of the samples, it is practically impossible to arrive at average figures. These are deduced with much greater accuracy from the yields of the distillation in bulk.

One fact, however, is clear from a study of the results of a large number of analyses of individual samples—that is, that a great proportion of the valuable lighter hydrocarbons is destroyed by the high temperatures which are maintained in large gas-works. Tars from the smaller gas-works, produced at more moderate heats, are generally much richer in benzene and toluene. Experiments are necessary to determine the most favourable conditions for the production and preservation of the lower members of the benzene series of hydrocarbons. No definite information is yet available; but there are indications that a relatively small sacrifice of the gas yield would greatly increase the proportion of benzene and toluene in the tar and gas. According to published figures, the Gas Light and Coke Company separated from 16¼ million gallons of tar:

90 per cent. benzol	81,500 gallons	= 0·50 per cent. by volume.	
90 ,, toluol	19,600 ,,	= 0·12 ,, ,,	
Total	101,100 ,,	= 0·62 ,, ,,	

The bulk of the tar is produced by the large gas and coke companies under high-temperature conditions; and these figures, therefore, give a good indication of the average quality of the tar distilled. Calculating therefrom, 1 ton of tar yields 0·95 gallon of 90 per cent. benzol and 0·23 gallon of 90 per cent. toluol; and the possible output of these products from 1½ million tons of crude tar may be estimated to be about 1½ million gallons of 90 per cent. benzol, or, allowing for the higher yields from the richer tars, about 2 million gallons, and the possible output of 90 per cent. toluol from tar distillation about a quarter of these figures.

The major portion of the lighter hydrocarbons remains in the cold gas. It has been the practice in coke-works for a considerable number of years to recover these by scrubbing the gas with creosote oil, and subsequently to distil them from the solution, with the help of steam. This practice has only been extended to gas-works since the outbreak of war. The yield of crude benzol per ton of coal carbonized in coke-ovens is usually from 2 to 3 gallons, and is probably of the same order in gas-works, though the remarkable figure of 4 gallons is stated to have been reached in one of the Manchester gas-works.

Finished Commercial Products.

Practical working yields of finished commercial products obtained per ton of coal carbonized in a large coke-works, and of pure products, over the more limited period during which these have been manufactured, are given below:

Commercial Products.	Gallons per Ton of Coal	*Pure Products.*	Gallons per Ton of Coal.
90 per cent. benzol	1·70	Pure benzol	0·88
90 per cent. toluol	0·31	95 per cent. at 90° benzol	0·72
Solvent naphtha	0·11	Pure toluol	0·33
		Xylol	0·05
		Solvent naphtha	0·05
Total	2·12	Total	2·03

Output of Benzol.

The following figures, based on the results of the carbonization of nearly 100,000 tons of coal in horizontal retorts, and showing the yields of unwashed, distilled products per ton of coal, have a special interest:

	Gallons per Ton of Coal.
96 per cent. at 90° benzol	1·23
90 per cent. toluol	0·23
Solvent naphtha	0·05
Total	1 51

The loss on washing may be assumed to be 10 per cent.

The output of benzol, expressed as 90 per cent. benzol, from coke-ovens in Great Britain may be estimated to be 17,000,000 to 20,000,000 gallons (68,000 to 80,000 tons) per annum. If the whole of the metallurgical coke now produced in the United Kingdom—approximately 12,000,000 tons per annum—were made in bye-product recovery ovens, the output of 90 per cent. benzol might be raised to 25,000,000 to 30,000,000 gallons (100,000 to 120,000 tons); and a like production might be expected from gas-works, if oil-washing of illuminating gas were universally practised.

Benzol as a Motor Spirit.

Until quite recently, the bulk of the benzol production was absorbed by the pure chemical and dye industries; but in the few years immediately preceding the war, the amount which was consumed as motor spirit greatly exceeded that used for all other purposes. Thus the consignment of benzol in Germany during 1910 totalled 67,790 tons, of which 32,300 tons were used in colour works, and 33,322 tons as motor spirit. Of the benzol produced in Germany during 1913, the probable consumption in motors was stated to be 80,000 tons, and for 1914 the estimate was 95,000 tons. This new development of the use of benzol took place principally in France, which imported supplies from Great Britain, Germany, and Belgium. In 1908, Great Britain exported 2,000,000 gallons of benzol and toluol, of which 1,000,000 gallons went to France; in 1913, the amount exported had risen to 6,650,000 gallons, of which France absorbed 6,320,000 gallons. The British export to the United States, on the other hand, reached its maximum value of 178,000 gallons in 1911, and fell to 4700 gallons the following year. According to a recently published estimate, the yearly production of benzol by American iron and steel companies now falls not far short of 25,000,000 gallons; and it is evident that the United States is no longer dependent on foreign supplies.

So far as the chemical industries are concerned—ignoring for the moment the present abnormal demand for the manufacture of explosives—the output of benzol is very greatly in excess of requirements; and the motor industry seems to offer the only possible outlet for the surplus production. The consumption of imported motor spirit in the United Kingdom has increased from 54,000,000 gallons in 1910 to nearly 119,000,000 gallons in 1914; and as the use of benzol for this purpose has long passed the experimental stage, the gas-works and coke-ovens of this country may be expected to supply a considerable proportion of this demand, if adequate facilities for the distribution of benzol to the consumer are provided. Reports on the use of benzol as a motor spirit state that it gives 15 per cent. more mileage per gallon than petrol; and these confirm the evidence of tests of the calorific value, which indicate that the heating power per gallon is greater,

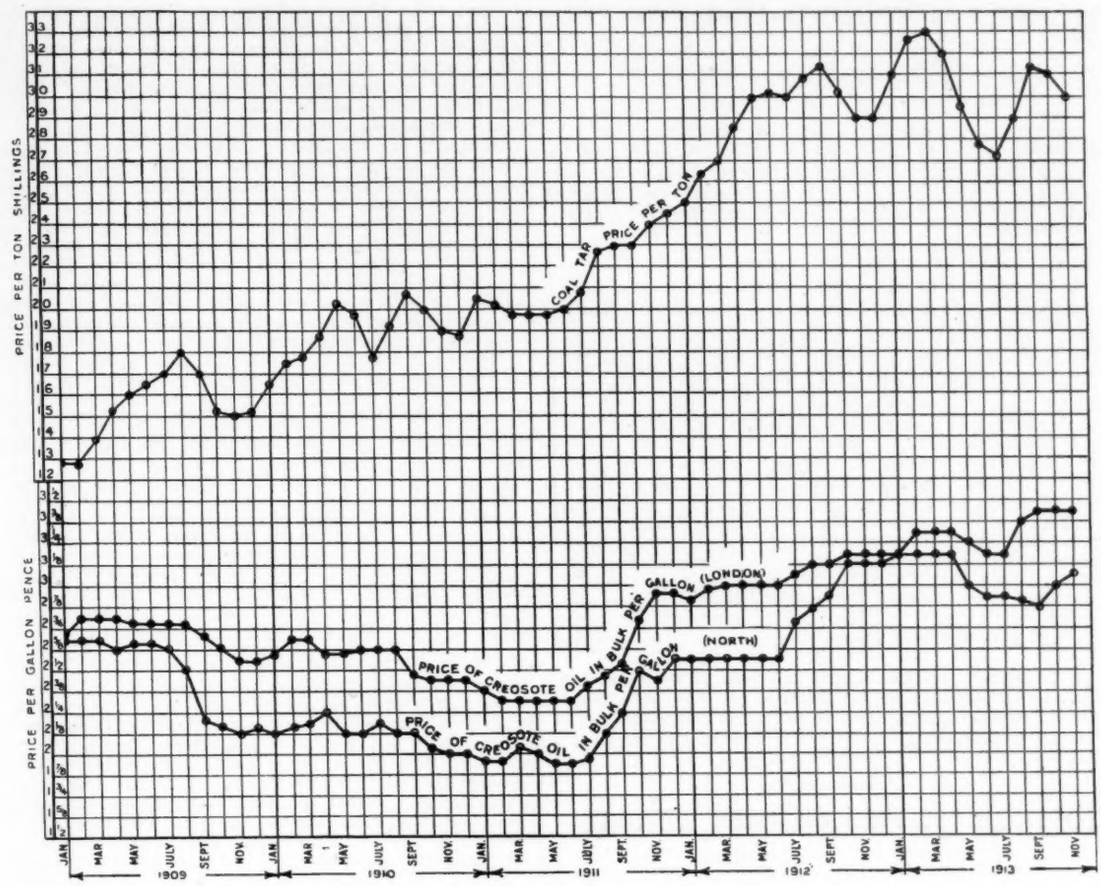

PRICE PER TON SHILLINGS
COAL TAR PRICE PER TON
PRICE PER GALLON PENCE
PRICE OF CREOSOTE OIL IN BULK PER GALLON (LONDON)
(NORTH)
PRICE OF CREOSOTE OIL IN BULK PER GALLON
JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV.
1909 1910 1911 1912 1913

FIG. 2.—PRICES OF COAL TAR AND CREOSOTE.

though the value per pound is less. The following statement shows the calorific values of the two fuels:

	Specific Gravity.	Net Calorific Values. British Thermal Units. Per Pound.	Per Gallon.
Benzol	0·883	17,270	152,500
Petrol	0·72	18,750	135,000

In order to counteract the tendency to freeze at winter temperatures, it is desirable to include the toluene fraction with the benzol; and, for use in abnormally cold localities, to mix the latter with petrol.

Creosote Oil for Engines.

Brief reference was made to the other products of the distillation of coal tar—the lecturer saying, with regard to creosote oil, that a relatively small proportion of the total production is treated with caustic soda to extract cresylic acid; and the washed oil, as well as the crude oil after removal of part of the naphthalene, is used as a fuel. Creosote oil has been employed successfully in Diesel engines. The consumption of the oil is somewhere in the neighbourhood of 0·5 lb. per brake-horse-power per hour; and, for this purpose, its value lies between three and four times that of coal. The oil from vertical-retort tar is presumably better adapted for use as a fuel in internal combustion engines; and a ready market for large supplies of this material is available.

Prices of Coal Tar and Products.

The concluding portion of the lecture, which was as follows, had reference to prices of coal tar and products.

Monthly average prices of coal tar, creosote oil, and 90 per cent. benzol, over a period of five years immediately preceding the war, based on the weekly quotations of the "Journal of Gas Lighting," are represented graphically in figs. 2 and 3. The prices of benzol up till Sept. 4, 1911, include casks, which were free, the subsequent figures are naked prices. The yearly average prices of creosote oil and benzol, based on actual sales in

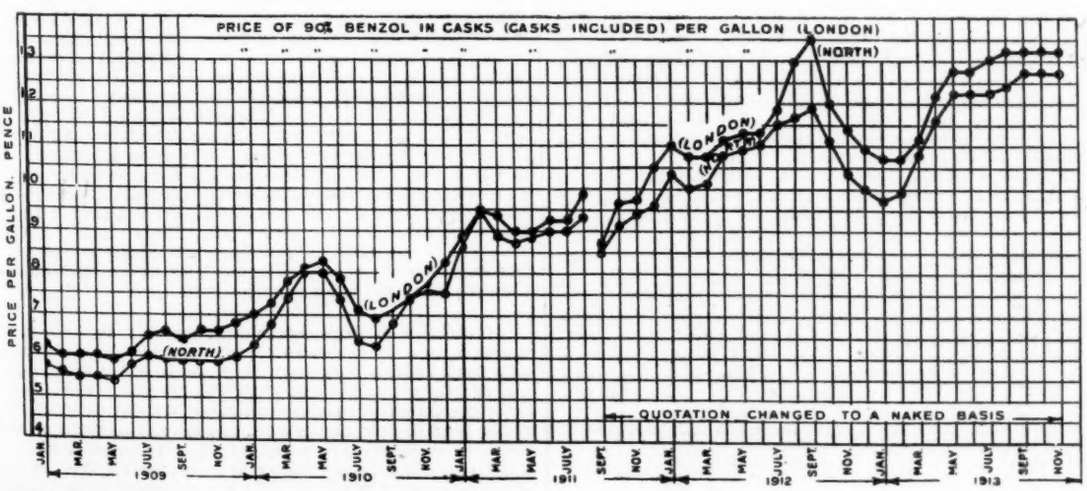

PRICE OF 90% BENZOL IN CASKS (CASKS INCLUDED) PER GALLON (LONDON)
(NORTH)
PRICE PER GALLON PENCE
(LONDON)
(NORTH)
QUOTATION CHANGED TO A NAKED BASIS
JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV. JAN. MAR. MAY JULY SEPT. NOV.
1909 1910 1911 1912 1913

FIG. 3.—PRICES OF BENZOL.

Glasgow, appear in the following table. The prices are "naked *ex*-works."

June 1 to May 31.	Blast-Furnace Creosote. d.	Coke-Oven Creosote. d.	Benzol (Average of 50 p.c. and 90 p.c.). d.	
1907-8. . .	1·85 ..	2·30 ..	7·55	
1908-9. . .	2·44 ..	2·60 ..	5·19	
1909-10 . .	2·17 ..	2·53 ..	3·77	
1910-11 . .	1·63 ..	1·77 ..	5 30	
1911-12 . .	1·72 ..	1·62 ..	7·33	
1912-13 . .	2·65 ..	2·64 ..	10 18 10·06	90 per cent. 50 per cent.
Jan. 1914. .	4·25 ..	3·00 ..	10·10	

A Solid Smokeless Fuel.

By the introduction of the vertical retort, carbonization costs have been greatly reduced; and the yields of gas, and particularly of tar, have been increased. As a result of the newer method of working, over-heating of the tar is largely prevented; and, though the resulting product is less suitable for the production of the substances required by the pure chemical industry, it is better adapted for use as fuel, and doubtless for other purposes. Since the coke industry, in connection with which high-temperature carbonization is necessary for the production of a hard metallurgical coke, is fully capable of supplying the demand for pure benzene and other high-temperature products, the question naturally suggests itself: Is it not practicable to go a step further in the direction of temperature reduction, or to shorten the duration of heating, so as to discharge from the gas-retort a less highly-carbonized material, which will contain a sufficient amount of volatile matter to permit it to burn in an ordinary open grate? The suggested method of working would certainly reduce the yield of gas; but the deficit might be made good by the addition of water gas generated from a portion of the coke in a separate producer.

The production of a solid smokeless fuel, suitable for domestic purposes, as a bye-product of the gas industry, would materially reduce the smoke nuisance in our larger towns, and would constitute a further important contribution by the gas engineer towards the solution of this important problem.

JACKSONVILLE INCLINED CHAMBER RETORTS.

On the cost of manufacturing carburetted water gas becoming excessive (owing to the rise in the price of oil), it was decided, at Jacksonville (Florida), in the autumn of 1912, to instal new coal-storage, gas-making, and coke-storage plant, &c. This included a bench of six full-depth settings of six inclined retorts, 15 feet long, a waste-heat boiler, exhaust fans, a steel retort-house with corrugated asbestos covering, flushing apparatus for the hydraulic mains, and coal and coke handling machinery.

Particulars of the plant, and of a subsequent installation of inclined chamber retorts, were given, in a paper read before the Southern Gas Association, by Mr. W. J. O'Rourke, who said that the first six settings of new retorts were put to work in 1913, and have been in continuous operation since that time. The coal is received in hopper-bottom cars, which are either dumped into the coal storage or into the track-hopper. From the track-hopper, the coal is carried by a steel apron conveyor to the crusher, from which it falls into a bucket elevator, and is carried into the overhead coal-storage bunkers of the retort-house. These bunkers have a capacity of about 150 tons; and the coal is dropped through four discharge valves into three travelling trucks, from which it falls by gravity into the retorts. The coke first falls from the retorts into water-sealed quenching bins, and then into a coke-car, which is elevated and run out on an overhead track, from which it can be dumped into cars or bins, or in the yard. The flushing apparatus for the hydraulic mains consists of a steel separating tank, which receives the tar and liquor of the hydraulic mains, and an ammonia pump, which forces the hot weak liquor from this separating tank, through jets in the bottom of each of the six separate hydraulic mains. Pitch, carbon, and heavy tars are forced out at the tar and liquor overflows. The tar from the separating tank runs to the tar-well.

In the spring of 1914, it was decided to double the coal-gas generating apparatus; but instead of the Ω-shaped retorts new chamber retorts of a rectangular form were decided upon. Six new settings were built, and another waste-heat boiler installed, and so arranged that the waste gases are drawn from the new settings through the waste-heat boilers by the exhaust fans.

Three of the new settings were filled with silica inclined chamber retorts, 16 inches wide, 28 inches high, and 15 ft. 9 in. long. They were set at an angle of 36°, and hold about 70 per cent. more coal than the Ω-shaped retorts. The doors being rectangular, the old cottar-bar is replaced by a hand-wheel, the screw working through the cross-bar against the door. This insures a tight door—there being no eccentric to become worn.

These inclined chamber retorts were the first installation carried out in the United States, and due credit must be given Mr. G. F. Goodnow, the Consulting Engineer for the Jacksonville Gas Company, who was instrumental in the development of this type of retorts—seeing the necessity of improving the quality of retort-house coke. The results on the chamber retorts were very satisfactory; and they have the advantage of easy operation, simple heat control, gravity charging and discharging, low labour cost, and better coke. In the spring of 1915, the three remaining settings were filled with inclined chamber retorts; and the whole installation has since been in continuous operation. The waste-heat boilers will generate enough steam for the entire coal-gas plant, excepting the sulphate of ammonia apparatus.

Six retorts are discharged and charged every two hours. At present the charge is 1250 lbs. of coal to a retort. There is a temperature of approximately 2400° Fahr. in the combustion chamber, and 2000° to 2200° in the retorts. The dip-pipes are sealed four-tenths of an inch; and the foul main is under a slight vacuum, sufficient to maintain a neutral condition in the retorts. The labour required to operate the twelve settings is nine men—four men to the night shift, and five men to the day shift. This includes the night and day foreman; but it does not include the man who puts coal into the overhead bunkers in the retort-house. The extra man on the day shift cleans the fires, carries away the furnace ashes, and furnishes other assistance. The average time for discharging and charging six retorts is twenty minutes.

As all the gas is drawn away by the one exhauster, the results of the chamber inclined retorts may be shown by taking the results of the past year and those of the year previous to that:

	1915.	1914.
Yield of gas per pound of coal carbonized .	5·42	.. 5·34
B.Th.U. per cubic foot	590	.. 593
Average make per man in retort-house cubic feet	108,000	.. 102,400
Gallons of tar per net ton of coal	11·5	.. 12·5
Ammonia per net ton of coal . . . lbs.	4	.. 4·53
Coke per net ton of coal . . . . . lbs.	1,328	.. 1,280
Bench fuel per net ton of coal. . . lbs.	260*	.. 263
Daily make per setting . . . cubic feet	82,000†	.. 102,900‡

* Furnaces charged with cold coke.
† Carbonizing twelve hours.
‡ Carbonizing six hours.

As to the amount of ammonia recovered, there was considerable trouble with leaks in the old saturator; but a new one has been installed, and the results have greatly improved. The gas made per man would be increased if only the chamber retorts were in use. The make per setting is low, due to the twelve-hour carbonizing; but the superior quality of the coke must be considered. The coke is large in size, of a hard, firm structure, grey in colour, closely resembling metallurgical coke; and it withstands handling and transportation. It is also suitable for the manufacture of water gas. The night and day retort foremen have other duties to perform. The demand for twelve-hour coke necessitates the use of the six-hour coke from the old retorts in the generators of the chamber retorts.

War Commissions and Committees.

From time to time, in different quarters, one has seen and heard comment upon the number of Commissions and Committees which have been set up to deal with public questions arising out of the war. From the frequent intimations of the constitution of new bodies which have appeared in the Press, it has been evident that the total number must be very large; but it is nevertheless to be doubted whether anyone who had not actually kept count would, if asked to make a guess, have placed the figure sufficiently high. The information has now been furnished by the Government themselves in a Parliamentary Paper, which gives the titles of the Commissions and Committees, together with the names and addresses of the Secretaries. The first mentioned is a Committee appointed to consider and advise upon applications received by the Treasury for approval of fresh issues of capital; and the second is the War Trade Department—set up to take over the bulk of the work done by the Committee on Trading with the Enemy, which is now dissolved. Passing down the list there is a Committee on the Supply of Chemical Products, and another on Production in Engineering and Shipbuilding Establishments; these being followed closely by a Coal-Mining Organization Committee, an Agricultural Consultative Committee on Home-Grown Food Stuffs, and a Committee to make arrangements with a view to the maintenance, so far as possible, of adequate supplies of fertilizers for the use of farmers in the United Kingdom. The Coal Exports Committee and the Excess Profits Duty Committee may be named together; and then there are several Munition Committees, a Board of Referees on Profits of Controlled Establishments; and a Distribution of Coal and Coke Committee. Among others which have had wide duties placed upon them are the Iron, Steel, and Engineering Industries Committee, the Committee on Work of National Importance, the Reserved Occupations Committee, and the body to consider trade relations after the war. The last one named is on Substitutionary Labour; and its number is ninety-four.

Production of Petroleum in the United States.—According to a compilation by the foreign trade department of the National City Bank of New York, says the "Board of Trade Journal," the United States produced 66·3 per cent. of the world's output of crude petroleum in 1915, as compared with 64 per cent. in 1910, 43 per cent. in 1900, 60 per cent. in 1890, and 88 per cent. in 1880. The total production of petroleum in the United States in 1915 was larger than in any earlier year—exceeding that of 1914 by 26,000,000 barrels. The world's production in 1915 (440,000,000 barrels of 42 gallons each) was also larger than in any earlier year—exceeding that of 1914 by 39,000,000 barrels.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Alien Enemy Members of the Institution.

SIR,—In your report of the Institution proceedings, there is a brief reference to Mr. Buckley's protest against the retention on the roll of the Institution of members of enemy alien birth. I think it would be unfortunate for the impression to get abroad that the members generally view this question with indifference. On the contrary, I know there is a very strong feeling on the matter. Personally, I should have stood up to support the protest, and only refrained from doing so because time was short, and the President was obviously anxious to proceed with the business.

I entirely agree with Mr. Buckley that it does not add to the dignity of the Institution, and is not fitting at the present time, that these members should be retained. Still less is it desirable that they should attend our meetings, particularly when, as has been the case on one or two occasions, we have been called together to receive information from the Government of serious importance to the country, and held to be of such a confidential nature that, not only could it not be published, but members were warned not to repeat it. The gas industry is vitally concerned in the supply of munitions essential to the carrying on of the war; and for this reason it behoves us to be exceedingly careful whom we admit to our meetings, and to avoid all risk of information useful to the enemy leaking out.

The members of enemy alien birth are certainly few in number; and if they had refrained from attending our meetings during the war, it is doubtful whether anything would have been said. But this has certainly not been entirely the case. As far as the question of any or all of them being naturalized is concerned, I can only say that I place the same high value on naturalization (mere scraps of paper) as the German Government and people themselves do.

I was more than surprised to find that the Council of the Institution had entrusted the investigation and report on "Gas-Meters" to Dr. Lessing. If there is no British-born chemist or gas engineer capable of doing this work, then I am truly sorry, both for our profession and country.

I have a very courteous letter from Mr. John Young, the President, saying that the question is to be considered at the next Council meeting, when I trust that the Council will take the dignified and patriotic course of excluding from the Institution members of alien enemy birth.

Gas Offices, Worthing, June 16, 1916. SIDNEY O. STEPHENSON.

National Gas Institution.

SIR,—I submit that the time is opportune to consider the advisability of the establishment of a National Gas Institution capable of embracing all the various gas interests. Such an Institution would, and should, be properly housed in a National Gas Institute worthy of the great industry.

All sectional names, which at present only emphasize differences, should cease to exist. It is foolish to talk, in pious horror, about "commercial and trading" interests interfering with "professional and technical" ones. Indeed, those who have done so in the past, have been found to be deeply immersed in trading interests, directly and indirectly, either as directors and shareholders themselves or through their relatives. One does not blame such men; only do be fair and not talk nonsense about "professional" and "technical" superiority.

It is time for some protest to be made respecting the complication of matters by the further appointment of cumbersome councils or committees, by whatever fictitious name they may be called.

15, *New Street, Huddersfield, June 14, 1916.* EDWARD A. HARMAN.

Carbonizing Coal in Thin Layers.

SIR,—In respect to the remarks in your editorial notes on p. 556, I should like to point out that, when coal is carbonized in thin layers at a medium temperature, the conditions approximate to the case in which coal is carbonized in full charges at a high temperature. In the former case, though there is a larger free space above the charge, there is a lower temperature; in the latter, the free space is reduced to a minimum, but there is a more dangerous temperature.

On the whole, I think that full charges and high heats are very much preferable to, and less dangerous than, smaller charges and lower heats, since the fluctuations in the conditions are reduced.

Newcastle Gas Offices, Tyneside Road, June 15, 1916. G. WEYMAN.

Need of Increased Coal Supplies.—Mr. A. H. Pease, presiding at the annual meeting of Messrs. Pease and Partners at Darlington, last Wednesday, said he had had special opportunities of gauging the requirements of the country for coal, ironstone, and steel; and the condition was becoming serious indeed as regarded coal. He knew of several works producing munitions which were unable to work the full time because of the need of coal. The success of the nation at an early date depended upon increasing the supplies. If the output could be raised by 20 million tons per annum, it would mean the saving of thousands of lives, owing to the increase of munitions. The firm's profit on coal and coke showed an advance; but there had been a further fall in profits for the year on bye-products. Tar was a drug in the market; and prices had fallen heavily. Their benzol products had been commandeered by the Government at prices little in excess of those ruling before the war; and the Government had declined to pay more. It was decided to pay dividends of 22s. per share on the ordinary and deferred shares.

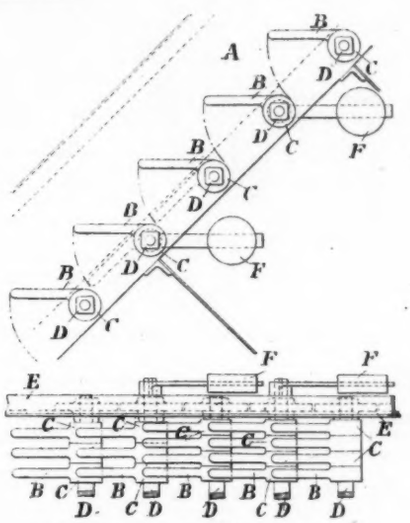
REGISTER OF PATENTS.

Grading or Screening Materials.

DUCKHAM, A. M'D., of Ashtead, Surrey.

No. 2469; Feb. 16, 1915.

The proposal here made for grading or screening material during its descent consists in delivering it first to a screen or sieve which permits only the finest grade to pass, and when this screen has become loaded to a certain degree, tipping it on to a second screen which permits the next finer grade to pass, and so on if more than three grades are required. In the preferred form of the invention, the screens are counterbalanced so that they tip their load as soon as this exceeds a certain amount—the screens being arranged like steps, carried on horizontal bars adapted to rock on their axes and having counterweights sufficient to support in a horizontal position the screen and its load until the latter exceeds a certain amount, whereupon the bar turns, the load is discharged on to the next screen, and the first resumes its former position, and so on. The invention is particularly applicable for separating the breeze from coke.



Duckham's Coke and Breeze Separator.

A side elevation and plan of a screening device constructed according to the invention are given.

The material to be screened is delivered to the shoot A and received in succession on fingers B of the respective screens. The bosses C of the fingers are provided with square eyes adapted to fit on the square sectional rocking shafts D. The width of the bosses determines the width of aperture between the fingers. In the example shown, there is the same width between the fingers of the first three screens, which discharge into a common shoot E. There is also a common, but greater, width of aperture between the fingers of the next screens, which also discharge into a common shoot a material of coarser grade than the preceding. The weight of the screen and of a certain amount of material is counterpoised by the counterbalances F, which are arranged at alternate ends of the respective rocking-bars D.

Manufacture of Liquid Organic Compounds from the Products of Distillation of Coal.

BERGIUS, F., of Essen-Ruhr, Germany.

No. 5021; March 31, 1915. Convention date, April 2, 1914.

This is a modification of patent No. 18,232 of 1914. In carrying out the process there described, with pressures of more than twenty atmospheres, it has been found that the hydrogenating reaction can be effected not only with coal and other solid carbonaceous material of vegetable origin formed by natural or artificial carbonization, but with certain products of distillation of coal and other carbonaceous materials—such as tar and pitch and other solid or liquid carbon compound obtained by distillation. It is possible to convert tar, the patentee says, by heating it with compressed hydrogen of more than twenty atmospheres to temperatures of about 400° C. into a fairly thin fluid, from which hydrocarbons having properties similar to those of rock oil hydrocarbons can be separated by distillation.

The process is applicable to solid and liquid hydrocarbon containing products of destructive distillation of coal and other solid carbonaceous material of vegetable origin formed by natural or artificial carbonization obtained at high temperatures in coking and gas-retorts. As an example, he mentions the heating of 1 kg. of tar with hydrogen at 100 atmospheres pressure to 400° C. in an autoclave. After four hours, the mass is distilled off; and 60 per cent. of the tar is distilled at about 250° C., and can be further treated by rectification.

Gas-Burners.—No. 100,464.

WINN, P., and WILKES, A. H., of Birmingham.

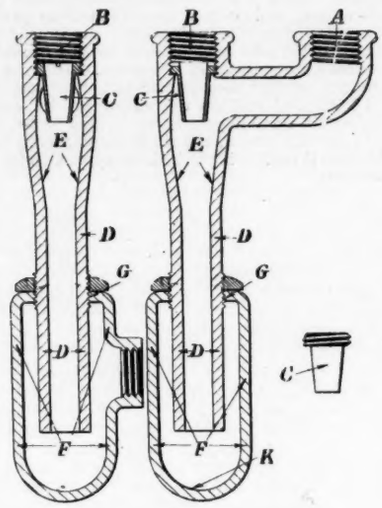
No. 3564; March 10, 1916.

This invention refers to burners consuming gas at normal pressures and compressed air, for heating furnaces or muffles. The compressed

air and the gas are introduced at separate inlets, and the compressed air draws the gas in at enhanced speed. The air and gas then flow together along the burner main shaft or tube and meet a baffle for ensuring their thorough mixture before the outlet is reached.

Sectional views of the supply tube and mixing chamber are given at right angles to each other.

A is the gas inlet pipe, and B the compressed air inlet provided with an injector nipple or nozzle C. The main shaft or tube D of the burner leads direct from the compressed air inlet, and is preferably tapered as at E. The mixing chamber F surrounds the end of the main tube, and has a tapped neck G screwing on to a threaded portion of D,



Winn and Wilkes' Heating Burner.

and a lock nut for locking or setting the chamber in any desired position. The other closed end of the chamber F is dome-shaped or concave, and forms a concave baffle K, against which the mixture issuing from D impinges and is flung back into the mixing-chamber and thoroughly mixed. The outlet pipe from the chamber F is at the side.

It is said that by the proper regulation of the baffle K from the end of the tube D—permitted by the adjustability of the chamber with respect to the tube, and by reason of the dome or concave form of the baffle—the burner "gives a flame of intense heat."

Gas-Furnaces for Heating Billets.

IONIDES, A. C., of Porchester Terrace, W.

No. 9568; June 30, 1915.

This furnace, intended specially for heating steel billets, consists of means for supporting a vertical column of the articles to be heated, and permitting the withdrawal of the lowest article of the column while continuing to support the remainder. It also consists in a furnace in which the discharging movement of a vertical column of articles to be heated is utilized to effect the addition of another article thereto from a second column, as by the provision of hydraulic pistons operating in interconnected cylinders to enable the weight of one column to counterbalance that of the other.

Such a furnace is preferably heated by the combustion of a low pressure self-burning mixture of coal gas and air in a closed chamber to which no other air is admitted, and from which the products of combustion are removed in a downward direction and passed into the atmosphere at a point below the level of the furnace—in accordance with the general method described in patent No. 15,455 of 1909.

High-Pressure Gas-Lighting System.

KEITH, J. & G., of Farringdon Avenue, E.C.

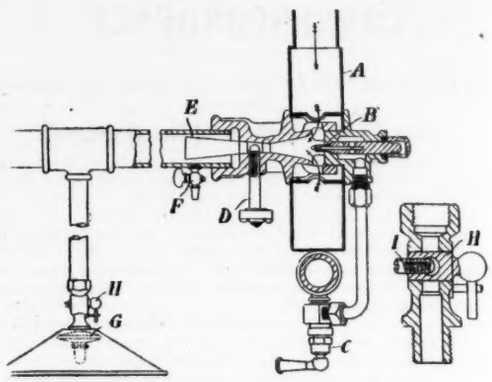
No. 9946; July 8, 1915.

This high-pressure gas-lighting system is designed to be installed in places where the conditions are such that burners of the usual types would rapidly become ineffective—due, for instance, to the presence of dust in the air at the point of illumination.

The patentees explain that it has previously been proposed to connect to a pipe line along which is distributed a series of burners an injector for supplying a self-burning mixture of gas and air to the pipe line—the injector being located outside the compartments to be illuminated; so that the air is induced into the pipe line at a point external to the compartments to be illuminated. This arrangement introduces practical difficulties, particularly in the case of large installations—for instance, the control of the injector from within the compartment.

The present invention consists, as before, of a pipe line along which is distributed a series of burners, and an injector for supplying a self-burning mixture of gas and air to the pipe line. Characteristic, however, of the present system is the arrangement of the injector, &c., within the building to be illuminated, and its connection to an air-duct which extends to a zone of fresh supply remote from the injector. Thus, "the invention ensures at one and the same time protection of the injector and associated parts, convenience of control of the quality of the mixture, and maintenance of delivery of pure air into the pipe line from a source remote from the injector."

The illustration is a part elevation part section of the injector and parts associated with it, and also showing one lamp fitting in connection with



Keith's High-Pressure Gas-Lighting System.

the main serving for the supply of the mixture. There is also a detail view of the cock provided on each lamp fitting.

In fig. 1, the injector device is shown coupled to the air-duct A, so mounted that the gas-nipple B may be readily removed for inspection and cleaning. Outside the duct, but within the place in which the burners are working, are fitted a cock C for controlling the gas supply and a regulating screw D, disposed transversely of the Venturi tube E and adjustable to regulate the mixture. The pet cock F affords a means of judging the quality of the mixture when the regulating screw is adjusted.

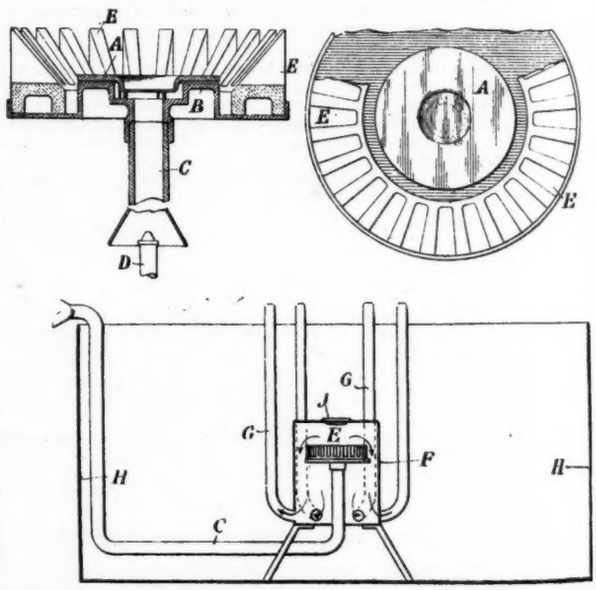
Each burner of the series comprises a heater G, to which is connected a nozzle and a reflector. Cocks (one of which is provided on each lamp) comprise in the instance shown a plug H screwed through the body of the tube sustaining the lamp, and fitted with a check screw I for choking the bore.

Gas-Burners.

SOUTH METROPOLITAN GAS COMPANY and CHANDLER, D., of Old Kent Road.

No. 13,595; Sept. 24, 1915.

In atmospheric gas-burners intended for use for industrial purposes, it is desirable, the patentees point out, to employ a combustible mixture which is self-supporting—that is to say, which has sufficient primary air in the combustible mixture to render it independent of any secondary air supply. Burners of this description, although theoretically of very high efficiency, and capable of employment in closed chambers, are liable in practice to be accidentally extinguished when there is any great variation in the proportions of the mixture.



Chandler's (South Metropolitan Gas Company) Gas Heating Burners.

The object of their invention is to provide means whereby self-supporting atmospheric gas-burners are instantaneously re-ignited, should they accidentally go out, or "perhaps it would be more correct to say, means whereby extinction is prevented." They say: "According to this invention, in an atmospheric gas-burner enclosed in a casing to which there is no admission of secondary air to aid combustion of the mixture, refractory material (sometimes called fuel) is placed in front of the burner flame, so that the latter will impinge thereon and raise it to incandescence. Thus should the proper proportion of primary air to gas become temporarily upset from any cause, the mixture impinging on the hot fuel will still be consumed, and there will be no extinguishing of the burner. As the upset of the proportion of primary air and gas is only due to temporary causes—such as a sudden draught or an

accidental variation in pressure—a proper self-supporting mixture is quickly re-established, and consequently no trouble results."

The burner it is preferred to employ in conjunction with the arrangement comprises a pair of plates set apart to make a slit for the passage of the self-supporting combustible mixture—the passage being of such width and length from the mixture tube to the point of ignition as will prevent any tendency to light-back along the passage. A pair of discs, one of which has a central hole for the end of the mixing-tube, will, it is said, make a good annular burner for the purpose—the distances between the discs and from the edge of the mixing-tube to the edge of the discs where the ignition takes place being such as to prevent lighting-back.

The invention is illustrated in sectional elevation and a (broken) plan view of the burner detached. The burner is also shown within a closed casing standing in a tank to contain liquid to be boiled.

The burner illustrated is an annular one comprising a pair of plates A B a suitable distance apart. C is the Venturi tube entering centrally the space between the discs through the middle of the disc B. D is the nipple which provides the gas. The dimensions of the Venturi tube and gas-nipple are so proportioned that the mixture is self-sufficient to support combustion—that is to say, requires no secondary air to enable the combustion to be complete. The flame will therefore continue to burn in a closed chamber so long as the proper proportion of primary air and gas is maintained. As, however, the gas and air are liable to temporary disturbance, it is proposed to employ means whereby in a closed casing such disturbances are prevented from causing the burner to go out. The means illustrated consists of a ring E, of refractory material, arranged in the zone of the flame from the burner. The ring is shaped with upstanding serrations, and rests upon a plate attached to the lower disc of the burner.

The burner, when enclosed in a metal casing F, is fed by a mixing-tube C entering through the bottom of the casing. G are flues for the escape of the combustion products—extending to a height sufficient for their ends to stand above the level of the fluid contained in the tank H in which the casing stands. The mixing-tube is long enough to be bent over the edge of the tank. J is a screw-down lid so that the burner may be lighted before the casing is immersed in the tank. After ignition, the flame of the burner plays upon the refractory material E, which, becoming hot, re-ignites the flame should it go out owing to any temporary upset of the mixture of gas and air supply.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for June 14.]

Nos. 7907—8256.

CHANCE and HUNT.—"Washing trinitrotoluene and other nitro compounds." No. 8234.
HICKINBOTTOM, F.—"Atmospheric burners." No. 7909.
HOLLEY, A. E.—See Chance and Hunt. No. 8234.
MOTT, O. E.—See Chance and Hunt. No. 8234.
PARKINSON STOVE COMPANY.—See Hickinbottom. No. 7909.
SANDOW, E.—"Gas, &c., cooking appliances." No. 7943.

English and German Chemical Industries.

Seconding the adoption of the report and accounts at the annual general meeting of Brunner, Mond, and Co., Limited, Sir Alfred Mond said there were few who, when the war broke out, anticipated the general upholding of their British commerce during the period of this struggle; and in this and other respects he thought the Company had astonished the world. "There is," he went on, "one general observation which might be made. We hear and read a great deal about the wonderful German chemical industry. Some people in this country seem not to realize that we have a British chemical industry. I was comparing the other day the balance-sheets of perhaps the largest and one of the best-managed German chemical works—I refer to the great dye-works of the Bädische Anilin und Soda Fabrik Company—and it will interest you to know that Brunner, Mond, and Co.'s profits are larger than those of the premier German dye-works; and as far as finance and capital are concerned, our position is as strong as that of any works in Germany. I say this because I think the position of the chemical industry in this country is rather apt to be overlooked by a good many people who write about matters of which they understand very little." It may be mentioned that Brunner, Mond, and Co's net profits for the past year exceed £1,000,000 sterling. An extraordinary meeting followed the general meeting; and at this the shareholders approved an agreement with the Castner-Kellner Alkali Company, to secure a close and intimate association between the two Companies.

Ilkeston Gas-Workers' Wages.—An application has been made to the Ilkeston Corporation by gas workers and others in their employ for an advance of 1s. per shift. The request is being supported by the District Executive of the Gas-Workers' Union; but in the present state of the borough finances, the time is not regarded as opportune for the concession asked for. The matter, however, has, on the proposal of the Mayor (who is Chairman of the Gas Committee), been referred to the General Purposes Committee for consideration.

Bourne Gas Undertaking.—At last Tuesday's meeting of the Bourne Urban District Council, the accounts of the Gas Committee were presented, showing a total income of £3151. The principal item of expenditure was for coal and carting, £1532; establishment charges and salaries, £403; repayment of loans and interest, £912; and discounts to consumers, £200. Other items of expenditure brought the total to £3484, leaving a deficiency of £333. Mr. T. M. Baxter (the Chairman of the Committee), in moving the adoption of the report, explained that coal during the year had cost £260 more than it had ever done before; while there had been no income from the lighting of the street-lamps.

LEGAL INTELLIGENCE.

LIABILITY FOR A HOTEL GAS BILL.

Judgment has now been given by Sheriff Lee at Airdrie in the action by the Burgh of Bridge of Allan against John Benson, accountant, of North Bridge Street, Airdrie, for £39 9s. 4d., being the amount of an account for gas said to have been supplied to defender as tenant of the Royal Hotel, Bridge of Allan, from May 15 to Sept. 30, 1915.—see "JOURNAL," Vol. CXXXIII. p. 539.

The defence was that there was no contract between the pursuers and the defender for the supply of gas to him, and that he never occupied the hotel in question or consumed the gas. The pursuers contended that he was the occupier, in respect of his name being officially entered as such on the valuation roll. The Sheriff has assoilzied the defender from the conclusions of the action, and finds the pursuers liable to him in expenses. The proof for the pursuers, he says, was mainly directed to eliciting the circumstances in which the defender's name appeared in the valuation roll for 1915-16 as occupier of the Royal Hotel. This entry might possibly have been founded on by the pursuers as *primâ facie* evidence of the defender's liability for the pursuers' gas account if it had appeared on the valuation roll before gas was supplied, and might therefore have induced or fostered the belief that the gas was being supplied on the defender's credit. But the valuation roll was not published, or indeed made up, until long after the gas account was current, and about the time when the pursuers were inquiring where they were to look for payment of it. In these circumstances any reference to the valuation roll is, in my opinion, quite irrelevant; but apart from this, the defender has been able to show quite clearly that he was entered as occupier by arrangement with the Assessor to get over a difficulty which occurred after most of the period covered by the account had run. The pursuers were aware that the former tenancy of the hotel ceased at May 15, and that from that date they were supplying gas to a new customer. They made no inquiry who the new customer was; but it is not alleged that they continued to supply in the belief that the defender, who is the owner of the hotel, was their customer. They had the power, if they wished, or if they were in doubt as to the payment, either to require a deposit or to put in slot meters. They did neither, and I think it must be assumed that their reason was that they were satisfied that Mrs. Crawford, who was the person *de facto* in occupation, was their new customer, and that her credit was good enough for them. Tradesmen in the town supplying other commodities had to consider the same position, and we know that they, either after inquiry or without it, supplied the hotel after May 15 on the credit of Mrs. Crawford as their new debtor. The burden of proof rests upon the pursuers; but the defender has been able to produce conclusive evidence that he was in no sense either the occupier of the hotel or the consumer of the gas between May 15 and Sept. 30. He was no more the pursuers' customer or ultimate debtor during the period than he was in the period which preceded it, and he neither did, nor admitted, anything which could have the effect of leading the pursuers to suppose that he would be, or could be made to be, liable in payment for gas supplied to the hotel of which he was the owner.

Claim for a Broken Street-Lamp.

At St. Helens, last Friday, Walter Richards, of Bolton, was summoned to recover £3 18s. 10d. for damage to a gas-lamp. Mr. Andrew (the Town Clerk) said Richards drove a heavy motor; and on March 13, the load caught a lamp-post, and broke it in three pieces. It was not necessary to go into the question of negligence, because the summons was taken out under section 20 of the Gas-Works Clauses Act, 1847; and when damage was done to the property of the gas undertakers (the Corporation), it was simply necessary to prove that the damage had been done. Mr. Busby, who represented the employers, protested against the summons being taken under this Act, and said that proceedings ought to have been taken in the County Court. Mr. Andrew: It is the law of the land. We have a similar clause in our Local Act; and there is a like clause in London. It is quite regular. Mr. Busby said that the lamp was knocked down by the load on the trailer moving because the wheel dropped into a street-grid. Mr. Andrew replied that this was not so. The motor, with a big load, tried to pass between the lamp and a tramcar. The Magistrates said they had nothing to do with making Acts of Parliament. They gave judgment for £6 14s. 10d., including costs.

Increase in Price at Tunbridge Wells.—The Tunbridge Wells Gas Company announce an increase of 2d. per 1000 cubic feet in the price of gas, due to the seriously increased cost of coal. The new price will, however, be only 2s. 10d. per 1000 cubic feet.

Increase in Price at Tottenham.—An increase of 5d. per 1000 cubic feet in the price of gas is notified by the Tottenham District Light, Heat, and Power Company. Alluding to the announcement, the "Tottenham and Edmonton Weekly Herald" says: "Thus this additional charge will come at a time when other household expenses and the income-tax have gone up considerably; and the thanks for this state of things is due, in a measure, to the attitude of one or two members of the Tottenham District Council, who induced their colleagues to refuse the Company's request to put up the price rather more than they did some months ago, and so equalize it with the charge for the ensuing period. We do not think ratepayers will feel very grateful to those members who had acceded to the appeals of all their other contractors in turn to put up the prices of their commodities to meet war charges, but declined it in the case of the Gas Company, which was hit quite as badly, but was only composed of 'shareholders,' who were not looked upon as 'traders.'"

MISCELLANEOUS NEWS.

GERMAN NITROGEN INDUSTRY AND AGRICULTURE.

[From the "Frankfurter Handelsblatt," May 29.]

We have received from the Sulphate of Ammonia Association the following extract from the "Frankfurter Handelsblatt" on the German nitrogen industry and the future of German agriculture. In a covering letter, signed by the Chairman (Mr. D. Milne Watson), which the Association are circulating with the extract, it is pointed out that they cannot vouch for the accuracy of the estimates presented, and one or two of the statements appear obviously exaggerated. They think, however, that the article shows clearly that the increase in production of nitrogen in Germany is likely to prove larger than has hitherto been expected. "This," it is added, "makes it all the more necessary that every effort should be made to cultivate and develop the market for sulphate of ammonia in this country."

During the last ten years, German agriculture has succeeded in increasing the yield of the land to an extraordinary extent; and in this connection a comparison with France is of interest. Thirty years ago the yield per hectare in France was about the same as in Germany. Since then, the yield in France has risen about one-tenth, whereas Germany has nearly doubled her yield, as the following table shows:

Wheat Yield per Acre in 100 Kilos.

Yearly Average.	1881-86.	1911-13.
Germany	12·8	22·3
France	12·0	13·6
Russia	?	6·9

This excellent result is due to the development partly of the Farmers' Associations, of Agricultural Schools, and the employment of modern methods, but chiefly to the ever-increasing quantities of fertilizers used. The following is a comparison of the amounts of fertilizers used per hectare during the last few years:

	Potash.	Nitrate of Soda.
Germany	12·05 kg.	8·10 kg.
France	0·806 kg.	4·10 kg.

Germany has always been well provided with potash, but up to about ten years ago had to rely almost entirely on imports of nitrate of soda for her nitrogen. The following table shows the increase in the imports of nitrate; and in this connection it should be mentioned that about 10 to 15 per cent. of these quantities have been used for industrial purposes.

German Consumption of Nitrate of Soda.

	1880.	1885.	1890.	1901.
Tons	55,000	155,000	330,000	517,000
Value (Million £)	?	1½	9½ (?)	4½
	1910.	1911.	1912.	1913.
Tons	723,000	703,000	785,000	747,000
Value (Million £)	6¼	6½	8¼	8¼

Gradually, however, the German chemical industry has been building up a substitute for nitrate in the form of sulphate of ammonia. At the beginning of this century, the production in Germany was still small, and imports amounted to about 48,000 tons per annum. Since 1906, however, things have changed, and Germany has exported larger quantities than she has imported. The development of our consumption of sulphate of ammonia is shown by the following table:

German Consumption of Sulphate of Ammonia.

—	Imports.	Exports.	Excess of Imports over Exports.	Excess of Exports over Imports.	Production from Coke-Ovens, &c.	Total Consumption.
1888	35,000	..	35,000	..	?	..
1900	23,000	2,000	21,000	..	104,000	125,000
1909	58,000	59,090	..	1,000	281,000	280,000
1910	31,000	93,000	..	62,000	313,000	251,000
1911	24,000	74,000	..	50,000	418,000	368,000
1913	35,000	76,000	..	41,000	501,000	460,000

The increase in the use of sulphate of ammonia has therefore been extraordinarily rapid. In the year 1913, 460,000 tons of ammonia were used, as against 750,000 tons of nitrate of soda. Taking the manurial value of sulphate compared with nitrate as 4 to 3, the 460,000 tons are equal to 610,000 tons of nitrate; so that the two competitors were running each other pretty close already in 1913. In 1914, synthetic sulphate of ammonia first entered the lists as a competitor of nitrate of soda on a practical scale. Theoretically, the possibility of producing ammonia by purely chemical means had long been known; and the well-known Norwegian method was first of all developed—the German chemical trade being largely interested. The difficulties of introducing this process into Germany, on account of lack of water power, forced the Bädische Aniline and Soda Works to develop a process of their own. In conjunction with Professor Haber, they proceeded to do this; putting all their energy into the Haber process, and giving up their Norwegian interests.

At the beginning of the war, the Company were producing on a scale large enough for one single works, but yet not sufficiently large to compensate for the loss of nitrate of soda. In the first year of the war, there was accordingly a considerable shortage of fertilizers for agricultural purposes. But our chemical industry quickly came to the rescue; and should the blockade of Germany be prolonged, we should soon be in a position to deliver more nitrogen for agricultural purposes than agriculture consumed in peace times. The following particulars give an idea of the extraordinary rapidity with which the Haber process has developed. The production rose from 30,000 tons in 1913 to 60,000 tons in 1914; and about the middle of 1915 the output of the original works was about 150,000 tons. From 1916 onwards the production is reckoned at 300,000 tons. It is no secret that the Bädische Company have lately begun putting up further large plants in another part of Germany; so that their producing capacity from 1917 onwards will no doubt be considerably in excess of that of 1916.

Assuming that the Haber production in the near future will amount to 500,000 tons, this process alone will represent the production of an amount of nitrogen very nearly equal to the amount of nitrate of soda we used to import. In passing, we may mention that such a production at a price of £12 10s. per ton would represent an annual turnover of 6¼ million pounds sterling for this one firm. Added to this, however, is the fact that, with State aid, further large quantities of nitrogen have been produced in the form of nitrate of lime, with the help of which our agricultural needs can easily be met. In addition, the whole tendency in the coal industry has been towards increasing the development of bye-products. Up to the time when the war broke out, about one-fifth of our coal was coked; but to-day the war has forced us to resort to coking to a far greater extent than before, and everything points to the conclusion that in the near future the direct combustion of coal will be recognized as altogether uneconomical, and disappear, and its place be taken by bye-product processes. This, of course, means increased recovery of ammonia from coal. Assuming that only double the quantity of coal hitherto used is employed for the recovery of ammonia, the increase in sulphate of ammonia production would amount to 450,000 tons. Basing upon the above, we can make the following comparison between 1913 and 1917:

German Consumption of Nitrogen, 1913.

Sulphate of ammonia	460,000 tons	=	92,000 tons nitrogen
Norwegian nitrate of lime	35,000 ,,	=	4,500 ,, ,,
Nitrate of lime	30,000 ,,	=	6,000 ,, ,,
Ammonia—Haber process	20,000 ,,	=	4,000 ,, ,,
Total			106,500 ,, ,,
Plus nitrate of soda	750,000 ,,	=	116,000 ,, ,,
Grand total			222,500 ,, ,,

German Production of Nitrogen, 1917.

Sulphate of ammonia	700,000 tons	=	140,000 tons nitrogen
Norwegian nitrate of lime	..		..
Nitrate of lime	400,000 ,,	=	80,000 ,, ,,
Ammonia—Haber process	500,000 ,,	=	100,000 ,, ,,
Total			310,000 ,, ,,
Nitrate of soda			?

If these estimates are only approximately correct, our own production will already next year be greater than our consumption before the war, including the amount of nitrate of soda imported. In case of need, therefore, we can do without the importation of nitrate of soda for agricultural purposes altogether. This does not mean, however, that the import of nitrate of soda is either unnecessary or undesirable. Nitrate will remain very much wanted for certain purposes; and agriculture will be glad to make use of it, as long as prices remain competitive—especially seeing the amount of German capital invested in the nitrate of soda business. If our home production of nitrogen can be supplemented by nitrate of soda, so much the better, for our experts are agreed that we cannot give our agriculture enough nitrogen. The dire necessity which this war has brought upon us, forcing us to help ourselves in all sorts of ways, has in this respect given us a valuable gift for the future, seeing that the new sources of nitrogen will enable us to increase our agricultural production.

All sorts of possibilities are involved in this. It would be thoroughly in keeping with the character and the accomplishments of the German chemical industry to proceed with the production of combined fertilizers after having successfully solved the problem of the synthetic production of ammonia. These manures will perhaps one day drive out the old fertilizers, the same as synthetic indigo drove out the natural product. It is not impossible that Germany may one day become the great exporter of nitrogenous fertilizers. The most important point, however, is the increase in the productivity of our land. The economy of £9,000,000 per annum of nitrate of soda imports cannot be compared in importance with the saving in our imports of wheat and foodstuffs which would be effected by means of increased fertilizing.

DÜSSELDORF GAS UNDERTAKING.

The report of the Düsseldorf gas undertaking for the twelve months ending March 31, 1915, has recently been issued. The output of gas for the period was 6·07 per cent. less than that of the preceding twelve months; the falling-off being entirely in the months following the outbreak of war. The works, having affiliated itself to the German Ammonia Selling Combine, undertook to make a high grade of sulphate—the percentage of ammonia now averaging 25·2 against 24·5 per cent. in the previous twelve months. Of the total output of gas, 98·4 per cent. was made in vertical and the balance in inclined retorts. The gas distributed amounted to 3129 cubic feet per head of the population in the district, against 3455 cubic feet in 1913-14. The mean gross calorific power of the gas was 537 B.Th.U. per cubic foot, at 60° Fahr., 30 in., and saturated, and the mean specific gravity was ·4106. The average composition of the gas, in volumes per cent., was: Hydrogen, 54·04; methane, 24·41; carbonic oxide, 9·33; heavy hydrocarbons, 3·25; carbonic acid, 2·39; oxygen, 0·87; nitrogen, 5·71. The tar made had a mean specific gravity of 1·105, and contained, on the average, 1·25 per cent. of water and 36 per cent. of pitch—*i.e.*, the residue left on distillation to 360° C. The clean gas contained 0·16 grain of ammonia per 100 cubic feet.

The works had a large store of coal at the outbreak of war, and sufficient deliveries followed during the winter months; but the quality of the coal then delivered left much to be desired, both in respect of gas yield and ease of working in the vertical retorts. It became necessary to mix the new coal with the old in store in order to secure satisfactory discharge from these retorts. The new coal, also, was very subject to spontaneous ignition.

BRADFORD GAS-WORKS ACCOUNTS.

At a meeting of the Bradford Corporation Gas Committee last Friday, the accounts for the year ended March 31 were submitted by Mr. F. O. Whiteley (the City Treasurer).

The income from the sale of gas last year increased £12,700, compared with the preceding year; while that from the sale of residual products showed an increase of £11,000. On the other hand, the cost of coal increased £12,640. The cost in coal alone of the gas produced worked out at 1s. 7d. per 1000 cubic feet, as compared with 1s. 3d. in the previous year. The cost under this head would have been still higher, but for the prudence of the Gas Committee in providing fairly large stocks of coal, and the fact that they benefited from purchases under old contracts. The total cost of the manufacture of gas, including coal, was equal to 2s. 3½d. per 1000 feet, as compared with 1s. 11d. Interest on loans and sinking fund charges amounted to £51,400, which was equal to 7d. per 1000 cubic feet of gas sold. The net result is much better than in the preceding year, the loss amounting to £2826, as compared with £14,400. A debit balance was brought forward from the year ended March 31, 1915, of £4400. To this must be added the loss on the past year's working, and also a sum of £8400, the proportion chargeable to revenue of the cost of the new vertical retorts at the Birkshall works, making a total adverse balance to carry forward into the present year of £15,600.

Having regard to the difficulties of the past year, the Committee expressed themselves as well satisfied with the result; and paid an appreciative tribute to the management.

NEW RIPON GAS COMMITTEE.

Following the refusal of the Local Government Board to approve of the borrowing of £9000, for works improvements, and the resignation of three of the Ripon Corporation Gas Committee, the remainder of the Committee have now yielded up their positions; and a new Committee has been appointed. Whereas the old Committee were in favour of the vertical retort system, the new Committee are a "horizontal-system" Committee—which means, of course, that no further step will be taken to carry out the scheme which had the old Committee as sponsors.

Nobody appears to have been particularly keen on membership of the new Committee; and at least one gentleman who was nominated declined to attend the meetings. But he was nevertheless elected. Some of the retiring members showed a particular anxiety that their critics should have a turn; and they were successful in this respect.

MOSSLEY GAS-WORKS REPORT.

In the course of his first annual report to the Mossley Corporation Gas Committee, Mr. J. M'Nicholl (the Engineer and Manager) states that the gross revenue for the year ended March 25 was £30,810, and the expenditure £22,662—leaving a gross profit of £8147, the net profit being £841. This is a result which, having in view the conditions obtaining, he regards as very gratifying. In spite of an increase granted, and a substantial payment to wives and dependants of men serving with the Colours, the wages bill for the year totalled £567 less than that of the preceding year. This saving is due in large measure to the introduction of stoking machinery, and in a smaller measure to restrictions on extensions imposed for economical reasons, and a desire, in view of the scarcity of labour, to carry on with the minimum number of workmen.

The amount of gas sent out from the works, Mr. M'Nicholl goes on to say, was very satisfactory up to December last, when the increase over the corresponding period of the previous year amounted to nearly 4½ million cubic feet, or 4½ per cent. But the reduction over the remainder of the financial year practically wiped-out this increase; and they finished the year with an increase of only 0·2 per cent. The decreased consumption during the last four months of the year was more than could be accounted for by the operation of the lighting restrictions, and was probably due in some measure to the reduced lighting in mills, owing to the stoppage of machinery for want of labour. If the decrease in consumption continues over the year just beginning, it would seriously affect the prosperity of the concern, as the already heavy burden of capital and other standing charges per 1000 cubic feet would be thereby increased.

In addition to the heavy increase in the price of coal, they have had to face an increase in price of practically all the goods and appliances purchased throughout the year, and also a very large increase in the amount required for rates and taxes. The sum paid for rates and taxes amounted to £1842, against £1033 two years ago; and he estimates that they will have to find another £1000 for taxes this year, or a total of nearly £3000—which will be equivalent to about 5d. per 1000 cubic feet sold.

A very satisfactory feature in the revenue account is the appearance of a credit on the debit side of the account under the heading of purification. The amount of the net credit is £139, representing (leaving out standing charges) a profit of approximately ¼d. per 1000 cubic feet of gas sold. This achievement, which is unique in the history of the undertaking, is due chiefly to the increased value of sulphur and sulphuric acid, in consequence of the large Government requirements; and the price of spent oxide, which is one of the raw materials used in their manufacture, has been increased in proportion.

The total number of meters fixed on March 25, and the number on the corresponding date in 1915, were as follows:

	1916.	1915.
Ordinary meters	4691	4689
Prepayment meters	2478	2426
Discount meters	692	719

The total amount of gas sold through prepayment meters amounted to 31,618,000 cubic feet, against 31,128,900 cubic feet the previous year.

BURTON-UPON-TRENT GAS-WORKS.

The Annual Accounts.

The report of the Gas and Electricity Committee, dealing with the past year's operations, came before the Burton Town Council at their meeting last Wednesday.

Alderman T. E. Lowe, in presenting the report, recalled the fact that a year ago he had to explain that, owing to various causes arising out of the war, the gas surplus profits had fallen to a very low level; and it was necessary to deplete the reserve fund in order to make a contribution to the rates which had been previously voted. He was now glad to be able to announce that they had once more made a very substantial profit, which amounted to nearly £15,000; and this was the highest on record. When they made the coal contracts a year ago, prices were generally up approximately 6s. per ton. Fortunately, they had large quantities of coal still to be delivered on account of the contracts for the previous year; and therefore the average price was only up 3s. 2d. per ton. As a set-off against this, they had the advantage of the increased charge for gas of 6d. per 1000 cubic feet for three-quarters of the year. Although they would have the advantage of a full year at the advanced price, this would not meet the extra cost of coal during the current year; and it was well that the Council should realize from the start that, though they had made such a large profit this year, it would not be possible to do the same again next year. Another factor which had had a considerable influence had been the very substantial increase in the price they had been able to obtain for coke; for whereas the average price of coal had only advanced 3s. 2d. per ton, the average price at which they had sold coke had advanced 6s. 2d. per ton. The new large retort-house had resulted in reducing the cost of stoking to a minimum. It was necessary in the Gas Department to provide the sum of £3950 out of the profits of this year to meet the depreciation on Consols bought for the reserve fund. The staff and workmen of the department had done their best to keep down the expenditure and produce a result which they all regarded as satisfactory. They had a reward through the profit-sharing bonus, the earnings of which amounted to £476, which would be distributed among them according to the scale. It might be of interest to state that about 40 of the Gas Department employees were now on active service in the Army, out of 150. Three, including one from the Electricity Department, had unfortunately lost their lives in France.

Mr. Slater expressed pleasure at noting that from the profit made the workmen had been rewarded for their labours.

Mr. King remarked that there was one point Alderman Lowe had not mentioned, and that was the unaccounted-for gas. It was a question he (the speaker) took a rather lively interest in some years ago. From the report it was gleaned that there was about 5 per cent. of unaccounted-for gas through leakage, while twelve or fourteen years ago it represented something like 12 per cent., and some years it was even greater than this. About £1000 worth of gas was manufactured every week; and the 7 per cent. saving meant a saving of £70 a week, or £3500 a year. He thought for this the Committee deserved some acknowledgment. The report was adopted.

The Report.

In the report, the Committee state that the total gas-works revenue for the twelve months ended March 31 was £74,893, and the working expenses £52,489. The net profit of £14,825 compares with £3561 a year ago. Of the surplus, £3950 has been allocated to depreciation of Consols, while £5875 has been transferred to the reserve fund and £5000 in aid of the rates. The net cost of gas per 1000 cubic feet sold, including all expenses for manufacture (less receipts from residuals), distribution, and all other charges, exclusive of interest and repayment of loans, was 15·4d., compared with the basis cost of 24d. set out in the profit-sharing scheme. The difference (8·6d.) represents, at the rate of ½ per cent. for every penny or fraction of a penny below 2s. as set out in the scheme, a bonus of 4½ per cent.; and this will be paid to the 143 employees of the Gas Department with three months' service or more. The earnings which participate in the bonus amount to £10,578, on which 4½ per cent. represents £476. The total quantity of gas sold last year was 391,899,400 cubic feet, as compared with 425,040,100 feet in 1915, or a decrease of 7·79 per cent., more than one-half of which is represented by the curtailment of public lighting. The gas made per ton of coal carbonized was 11,075 cubic feet, against 10,621 feet—an increase of 454 cubic feet, or 4·27 per cent.

WOMEN AND GAS SUPPLY WORK.

In Every Department, including the Laboratories.

The following interesting article appeared in "The Page for Women" in the "Daily Telegraph" last Saturday:

The South Metropolitan Gas Company has over 380,000 customers, and of these 320,000 use cookers. Sunday from eleven a.m. until dinner time is the busiest period of all the week, for the roast served in most households on that day is in the oven; and any failure of the gas supply would cause consternation to a host of housewives. Quite 2500 of the Company's employees have joined the King's Forces, so that there might have been a decided shortage of labour had not women proved themselves efficient. "In every department where we have engaged the services of women," said the Secretary to a "Daily Telegraph" representative, "they have shown that they have brains, and know how to use them. The result is a large number of women employed in various directions."

The secret of success lies, usually, in the art of selecting the right person to fill a given position. It would be a shortsighted policy to give women of slender physique tasks demanding strength. So women are chosen with discrimination by a lady superintendent, who has already placed 180 in the service of the Company. Apart from these later additions, there is a domestic staff of seventy or eighty on the

premises, several of whom are widows of men who have given their lives for their country. Among the many instances of successful enterprise, none is more important than the entrance of women into the Company's laboratories. There trained chemists are doing research and testing work with results qualified as quite good. The largest number, naturally, are engaged in clerical work in all its branches. In every department hitherto filled by men women are doing well. Some are in the drawing office; and others have taken on the duty of visiting houses and shops attending to gas-burners and similar duties.

The woman lamplighter is one of the latest arrivals. She started her duties just about a month ago. So far the daylight extension scheme has not made any difference. What really has to be taken into account is fluctuation in the hours of labour from week to week. Quite recently the hours were from nine to ten p.m. for lighting the lamps and three o'clock in the morning for putting them out.

Throughout South London a great many penny-in-the-slot meters are in use. Young women have been trained to attend to these, and are now fairly proficient in repairing, making small alterations, correcting inaccuracies in the mechanism, and in dealing with the various mistakes and errors that occur in the average small household consumption. The number thus employed will probably increase. A few women are driving motor-vans for the delivery of goods; but, so far, none have been employed in the delivery of gas-stoves or of coke, such tasks being judged too heavy for them to attempt.

Seven women are collecting money from the meter-boxes, in spite of the weight of the leather bags containing the coppers. The woman collector carries as much money as she can, and puts it into the nearest bank in the neighbourhood in which she is working. There is a scarcity of copper coinage, so people in the house are often glad to have their pennies back in exchange for silver, and in shops it is quite customary to give the collector silver for a batch of pennies. The woman in the show-rooms in outlying districts is an important person in the gas business. On her devolves the task of displaying and explaining novelties and of interesting people in new types of gas fitments of various kinds. About half-a-dozen are already occupied in this way; and they are among those whose services are described as excellent.

Price of Gas at Brighton.—When the minutes of the Lighting Committee were before the Brighton Town Council, Mr. Black, alluding to a letter from the Gas Company giving notice of an increase of 3d. per 1000 cubic feet in the price of gas, said the profits of gas companies throughout the country were on the increase; and the price for residuals was higher than ever was known within the recollection of man. [A Voice: And gas is worse.] If the Brighton Company were paying less dividend than before, he suggested it was by following methods which were not entirely ethical—to use no stronger phrase. It might be well, we suggest, if Mr. Black took further steps to ascertain the precise facts of the case.

GAS UNDERTAKINGS AND THE COAL SUPPLY.

The reduced coal output, says the "Yorkshire Post," referring to the question as it affects gas undertakings, "is causing anxiety to gas manufacturers in various parts of the country, especially those about to enter upon new contracts. With some who have run short of supplies, it is a question of getting coal almost at any price, despite the theoretical restriction laid down by Act of Parliament. It is notorious that the limitation of 4s. a ton increase upon pre-war prices is not being adhered to—coal in Newcastle, for instance, having recently changed hands at 60s. a ton. Still, the gas producers are determined to make a fight against this tendency; and they have recently formed an important Committee to watch their interests, and, if possible, to bring the whole body of gas manufacturers—corporation as well as company—into line. The question, however, is complicated; and there is some difference of opinion as to how far the Act of Parliament operates in new arrangements made upon the basis of contracts still running in the six months before the war. Within the past few months, the Act has more and more fallen into abeyance; and corporations have had to enter into contracts on the basis of 6s. and 7s. advance upon pre-war rates. In some quarters, indeed, the feeling prevails that, in the view of the Government, the Act has already done its work. But this may be nothing more than an impression. Conditions have vitally changed since the Act was passed; and in some localities the colliery proprietors are asking the Board of Trade to ease the limitation. If, however, this were granted, the Government would take 60 per cent. of the increase, and the men might conceivably put forward a demand for some of the remainder. Besides price, there is the question of supply; and the new Committee will no doubt approach the Government with a view to securing that producers of gas and electricity have due consideration. This, of course, will not be difficult for those places which are supplying the Government with bye-products for explosives; but the public interest demands that others shall not be left in the lurch, though the situation is rendered immensely difficult by the competing claims of the many new munition factories which are being started."

BENZOL PRODUCTION IN AMERICA.

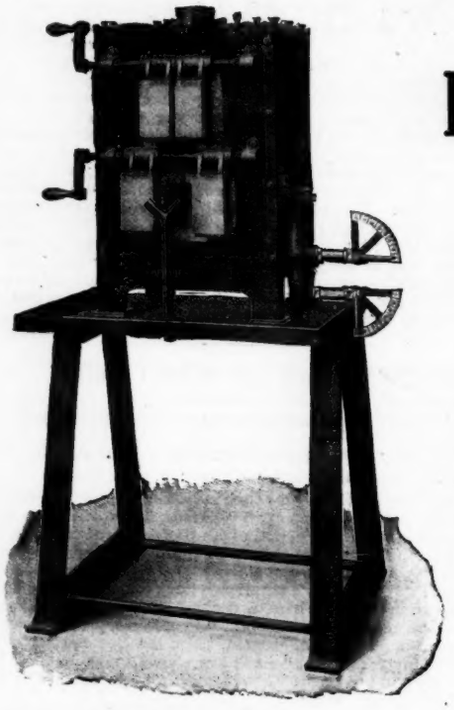
Writing in the "American Magazine," on the progress and developments that have been made in certain branches of the American chemical industry since the commencement of the war, Mr. A. W. Atwood makes the following remarks on the subject of benzol.

Among those steel concerns which have rushed wholesale into the manufacture of benzol are the United States Steel Corporation, the Lackawanna Steel Company, the Republic Iron and Steel Company, and the Midvale Steel and Ordnance Company. Such is the present

Consumers working with High-Speed-Steel Tools should be told of

WRIGHT'S GAS-HEATED

HIGH-SPEED-TOOL FURNACE



For Hardening, Re-heating and Annealing Tools, Milling Cutters, &c.

SOME OF THE ADVANTAGES—

PRE-HEATING CHAMBER for pre-heating tools *gradually* to a medium temperature.

FURNACE CHAMBER for the final *quick-heating* of tools to a high temperature suitable for quenching, &c.

PATENT "WRIGHT-BRAYSHAW" BURNER—the construction of which prevents air-currents inside the Furnace Chamber, and prevents blistering. It also gives results, in increase of heat and consequent decrease of gas consumption, far beyond anything attained by any other burner.

The DOORS of these chambers slide outwards with a downward turn of the handles at side.

Our New List (No. 14), sent Post Free, describes this and many other new Furnaces.

JOHN WRIGHT & CO., Essex Works, BIRMINGHAM.

demand for coke bye-products, that the steel companies are paying the cost of their new ovens in from six months to a year. By the end of this year, if the war continues, they will have wiped-off any capital charge whatever in this enormous new branch of their business. Most of the benzol produced by the steel makers is being handled and marketed by the Barrett Company, who have long been the dominant interest in American tar, pitch, creosote, roofing, naphthalene, and similar products. Isaac D. Fletcher (the Chairman of the Company) and William Hamlin Childs (the President) may be said to be in a sense the fathers of the coal-tar industry in America.

Even if the much-discussed dye industry should catch up with that in Germany while the war lasts, it may be ruined after the war, unless there is ample tariff protection. For the German dye and chemical makers are permitted to form "cartels," or cliques, through which all the members meet *pro ratâ* the losses of such manufacturers as are designated to "dump" products in foreign countries at prices below the margin of profit. One of the surest ways of meeting future contingencies has been taken by three of the great factors in the American coal-tar industry. The Barrett Company, the General Chemical Company, and the Semet-Solvay Company have each invested a one-third interest in the Benzol Products Company, whose plant will be able, if any American plant is, to meet German competition after the war. What it means that these three interests should join together in such an enterprise, can hardly be exaggerated.

The Semet-Solvay Company is one of the unsung titans of trade, practically unknown to the public, except in one or two localities, and yet standing far above all rivals in a great, essential industry. The Solvay plants are all over the United States; but the central unit is near Syracuse, New York. Although at least one of its processes of making soda from salt is that of Ernest Solvay, the dominant interest in the Solvay business in this country is the Hazard family. Needing a certain coal-tar product in their work of soda making, the Hazards long ago entered the coke-oven field; and when the war began they were the primary and central source of benzol in the United States.

TRIBUNALS AND EXEMPTION APPLICATIONS.

Before the Worthing Tribunal, four applications were made by the Gas Company—for a fitter and fixer of gas apparatus, a mainlayer, a meter repairer and general works fitter, and a storekeeper. The Manager (Mr. S. O. Stephenson) said the Company had already lost as many men as they could afford to, if they were to be safe with the gas supply of the town. They had parted with 33 for the Army, out of 80 or 90. Three months' exemption was given in each case.

Mr. A. P. Allan, the Manager and Secretary of the Scarborough Gas Company, applied for exemption for six employees of the Company. These included two main and service layers, two fitters, one assistant distribution superintendent, and the Manager and Secretary's clerk. The Tribunal granted conditional exemption in all the cases.

By the Tunbridge Wells Tribunal, Mr. S. J. Martin, Chief Inspector to the Gas Company, was granted conditional exemption for six months, on the Company's application. They also appealed on behalf of the chief prepayment collector, who, it was stated, supervised the collection of the money from the prepayment meters. There were, it was pointed out, 5000 meters to be collected from; and the total number of pennies taken last year was something like 4,000,000. Conditional exemption for six months was allowed.

Claiming that he was the sole remaining plumber, gas-fitter, and sanitary engineer in South Bank, near Middlesbrough, Simon A. Wood asked the local Tribunal last Tuesday for absolute exemption. He said he had the majority of the repair work in the town; and there should be somebody in his line of business left in the place. He was granted a month.

At the Southwark Tribunal, Messrs. R. Richards and Co., water engineers, of Upper Ground Street, S.E., applied for the exemption of three well-borers. The firm hold several Government contracts for the boring and fitting-up of wells, including one at the military camp in Essex. It was stated that the men were in certified occupations, as they were engaged on work of public utility; but this was opposed by the Military Representative, on the ground that the applicants were a private company engaged in boring artesian wells. The objection was surmounted by granting the men conditional exemption, on joining the Volunteer Training Corps.

CENTENARY OF ILLUMINATING GAS IN AMERICA.

Celebration at Baltimore.

Last week, the hundredth anniversary was reached of the successful use of illuminating gas in America. Baltimore, it is said, was the city in which artificial gas had its start, its value being demonstrated there; "and," says the local "Sun," (in a long illustrated article published in anticipation of the celebration of the event), "because of this fact, Baltimore may claim rightfully the honour of being the birthplace of this tremendous industry and help to humanity." The dates of the celebration were June 16 and 17; and elaborate plans were made for a fitting observance of the occasion. The programme drawn up by the officials of the Consolidated Gas, Electric Light, and Power Company included an industrial parade, in which several thousand men were to take part.

The development of gas, our contemporary points out, has been so astonishing, and covers such a vast field of discovery and achievement, that one finds it difficult to believe that it was only a hundred years ago that the citizens of Baltimore were paying for admission to see the first gas-lights ever lit in the city displayed as museum oddities. The place was the old City Hall, which at that time was known as Peale's Museum, and contained all sorts of queer, outlandish things. Rem-

Main Matters.

THE swelling popularity of the "Main" Gas Cookers is explained by their true qualities. While they are made in many different sizes and designs, they are all similar in that they are reliable, durable, and of real value. Mains are the cooker experts and are equipped to deal with every class of cooker business. Let them deal with yours.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

brandt Peale, the builder, is said to have made on the premises the gas used for the purpose of the display. Peale's Museum was thus the first building in Baltimore to be lit with gas; and according to most accounts, it was the first public building in the whole country to be so illuminated.

Peale announced the presence of his gas-lights in the Baltimore papers of June 13, 1816; and four days later an ordinance was passed granting the right to the Gas Light Company of Baltimore to manufacture gas and lay pipes in the streets. In the same instrument, the Mayor was given the necessary authority to contract for the illumination of the city.

Several months later, the Company was given a Charter. Thus was launched America's oldest Gas Corporation. The men who backed it were all prominent; the original incorporators including Peale, Long, William Lorman, James Mosher, and William Gwynn (the Editor of the "Baltimore Gazette"). In quick succession, other cities followed in Baltimore's footsteps, the quality of the gas was improved, inventors turned their attention to creating new paraphernalia, and within a few years the new industry was growing in an amazing way.

The Baltimore Company has a proud record in that during the entire hundred years since it has been in existence—the Consolidated Gas, Electric Light, and Power Company having had its origin directly in the old Gas Light Company of Baltimore—it has never "fallen down on the job." Which means that not once in the span of the entire century has Baltimore been left in darkness. There have been many trying tests; the most severe having occurred during the great fire of 1904, when many of the mains in the downtown district were broken. The electric lights failed; and the terror of the city would have been greatly magnified, and the danger would have been much increased, had it not been for the gas-lights. Thanks to the policy of preparedness, there was a sufficient reserve to serve the purpose when it became necessary to cut off the ordinary supply.

One reason for the fact that Baltimore has been able to maintain the premier position it took a century ago in the gas industry is to be found in the type of men who have directed the destinies of the controlling Company. From the very beginning, they have been representative of the very highest intellectual and business type—men not only of achievement, but of keen judgment and broad vision. The first President was William Lorman, who served from the inception of the Gas Light Company of Baltimore until 1832; being succeeded by General Columbus O'Donnell, who continued head of the Company until 1871. The present officers are: Mr. Herbert A. Wagner, President; Mr. C. M. Cohn and Mr. C. E. F. Clarke, Vice-Presidents; Mr. John L. Bailey, Treasurer; and Mr. William Schmidt, Jun., Secretary. Mr. J. E. Aldred is Chairman of both the Board of Directors and the Executive Committee.

The Company's equipment has kept pace with its rapid growth; and the Spring Gardens works, where gas is manufactured, are as picturesque as interesting. The largest structure in the city, the 6 million cubic feet gasholder, dominates the place. The works have an area of 57 acres, and are connected with the coke-ovens of the Maryland Steel Company, at Sparrows Point, 12 miles away, by a 20-inch pipe-line. The territory supplied with gas is 110 square miles, 31 of which belong to Baltimore city; 733 miles of pipe being required for the distribution. The number of services a year ago was 119,044; 121,866 meters were in use; while the number of gas-ranges and gas water-heaters was, respectively, 102,874 and 25,712.

Distribution shops which cover nearly 2 acres serve as headquarters for the 1000 men who supply the needs of city consumers in the application of gas; and there is a station in West Arlington for distribution work in the suburbs. The fact that the Company have outgrown their office facilities was recognized some time ago, and resulted in the adoption of plans for a magnificent new building, now being rapidly erected. This will be twenty storeys high, and will be built of granite and terra cotta—all four sides being finished in the same materials.

SHEFFIELD CORPORATION WATER DEPARTMENT.

Report of the General Manager.

The report on the working of the Sheffield water undertaking for the year ended March 25 last, which Mr. William Terrey (the General Manager) has submitted to the Water Committee, shows that the capital expenditure at that date amounted to £3,857,044. The income from all sources was £213,332, an increase of £11,280, or 5·58 per cent., over the previous year. Deducting the working expenses, there was a net revenue of £165,693, or £9045 more. Practically the whole of this sum was absorbed by annuities, interest, and sinking-fund charges, and Derwent Valley Water Board precepts; the surplus on the year's working being £6, as against a deficiency of £3554 last year. Making allowance for water supplied without charge to the Health and Highway Committees, and charges in connection with the Rivelin Valley estate, there is a net deficiency of £8191. It is pointed out that a further reduction made in bath and water closet charges represents a diminution of income for the year of £7203.

The estimated average population supplied within the statutory district (extending over an area of 134 square miles) is 495,927, an increase of 0·45 per cent. The Corporation also supply water in bulk to Rotherham, Doncaster, Rotherham rural district, Chapeltown, and other outside districts, representing an additional population of 188,548, and making the total population supplied from the works of the Corporation 684,475. The number of houses supplied within the statutory area is 114,813. There are 4416 water-meters now in use, as against 4350 last year. The total domestic and trade supplies on March 25 was 232,035, being an increase of 1836 supplies during the year. The quantity of water supplied from the works of the Corporation in 1915-16, including the statutory compensation water to the Rivers Rivelin,

The scientific validity of the Adjustable SIDE Ventilating Principle embodied in the DAVIS "Pandora" Series of Gas Fires

has NOT been questioned

On the contrary, it has been most emphatically endorsed by that distinguished authority on Heating and Ventilation, **Mr. A. H. Barker, B.A., B.Sc.,** &c.,&c.

THE DAVIS GAS STOVE Co. Ltd.

The Gas Exhibition Salons,
60, OXFORD ST., LONDON, W.

Loxley, and Little Don, was 12,072 million gallons. For domestic and all other supplies not by meter, including water supplied for fires, and waste, the average rate of consumption per head per day was 16·81 gallons, compared with 16·14 gallons for 1914-15. For trade purposes, by meter, the supply was 14·31 gallons per head, against 12·77. Thus the total consumption per head per day in the past year was 31·12 gallons; the figure for the previous year being 28·91 gallons.

NOTES FROM SCOTLAND.

Coatbridge Provisional Order.—Negotiations are in progress between the Town Council and the Coatbridge Gas Company with reference to the clauses of the new Provisional Order desired by the Company. The Law and Parliamentary Committee recommended that the Company be asked to modify and amend the Order as follows: (1) To restrict the application for new capital to one of £30,000, with corresponding borrowing powers; (2) to retain section 34 of the Gas-Works Clauses Act, 1871; and (3) to limit the deficiency in calorific value allowed, before penalties become enforceable, to 5 per cent., instead of 7½ per cent. Pending negotiations with the Company, it was agreed that a petition should be lodged against the Order. In reply to the Town Clerk's communication to the Company conveying the above recommendations, the Secretary wrote that he was authorized by the Company to restrict the application for new capital to one of £30,000, with corresponding borrowing powers, and to retain section 34 of the Gas-Works Clauses Act, 1871. But the Directors were of opinion that the deficiency in calorific value allowed, before penalties become enforceable, should remain at 7½ per cent. The Town Clerk, along with Treasurer Lovell, was authorized to continue the negotiations with the Company.

New Holder at Cambuslang.—A new gasholder has been erected at Cambuslang, Glasgow, at an outlay of £14,000. The Chairman of the Gas Company (Mr. Robert Black) presided over the gathering at the works in connection with the inauguration of the holder; and Mrs. Black, who had driven the first rivet, turned on the gas. The Contractors were Messrs. R. Dempster and Sons, of Elland.

Arbroath Gas-Workers' Wages.—The employees at the Arbroath Gas-Works having applied for an increase of 1d. per hour on the present wages paid, the Gas Committee recommended the Town Council to grant a war bonus of 1s. per week to the fitters, office staff, and the workmen.

Dearer Gas at Stirling.—Owing to the Summer Time Act, and the increased cost of materials, &c., the Stirling Gas Company are raising the price of gas from 3s. 2d. to 3s. 4d. per 1000 cubic feet.

Reduction in Price at Dunfermline.—The Dunfermline Town Council have reduced the price of gas from 2s. 11d. to 2s. 6d. per 1000 cubic feet for customers within the town boundaries, and for others from 3s. 9d. to 3s. 6d. The reduction is made possible by more favourable coal contracts entered into, and because of the increased prices for residuals.

Leven Gas Company's Dividend.—The Leven and Methil Gas Lighting Company have £2380 to the credit of the profit and loss account for the past year, and are paying a dividend of 12 per cent. The coal bill is £6706, against £4878 for the previous year, though the quantity of gas is down. The income is £9571, which is an increase of £170.

Wages Increased at Perth.—It has been decided by the Perth Gas Committee to grant an increase of 2s. per week to all employees in the gas-works who have been there since the outbreak of the war.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June* 19.

Pitch is steady at 19s. to 20s. per ton net in bulk at makers' works; this being the value for large business. There is a fair amount of inquiry for export for shipment over next season. Other products remain unchanged at the prices last recorded.

The position of sulphate of ammonia is rather better, and sellers are looking for higher values.

Tar Products in the Provinces.

June 19.

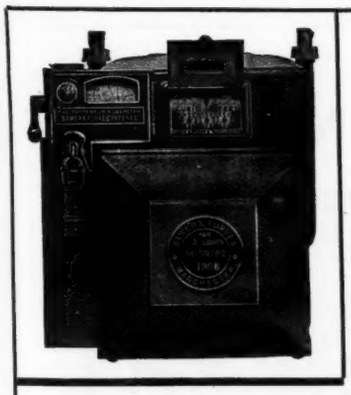
There is nothing fresh to report concerning the markets for tar products. In each case the price remains the same, and very little fresh business is reported in any article.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3⅜d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *June* 17.

Throughout the week the tone of the market has continued very firm, and a further small advance in values has taken place at Liverpool and Leith, although Hull delivery has remained unchanged.



The "Positive"

"THE METER OF MANY MERITS."

SAWER & PURVES,

MILES PLATTING, MANCHESTER.

BRANCH OF METERS LTD. RADFORD ROAD, NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

There has been a fair demand for munitions, and foreign buyers have again shown more interest in securing their supplies. The closing quotations are £16 17s. 6d. to £16 18s. 9d. per ton f.o.b. Hull, £17 1s. 3d. to £17 2s. 6d. f.o.b. Liverpool, and £17 3s. 9d. to £17 5s. f.o.b. Leith. For delivery during the second half of the year, £17 7s. 6d. per ton f.o.b. Liverpool has been paid several times, and some makers are now holding for £17 10s. in this position.

Nitrate of Soda.

The market for this material is quietly steady, and spot quotations are repeated at 18s. 4½d. per cwt. for ordinary, and 19s. 1½d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that the value of this article remains the same, and the prices are as follows: Outside London makes, £15 15s.; Hull, £16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal market has shown ease, due in great degree to the scarcity of steamers for early loading, and to the diversion of some vessels into other trades. In the steam coal trade, this lack of tonnage seems to have been more felt, and prices have been irregular. Best Northumbrian steams are quoted from 52s. 6d. to 60s. per ton f.o.b., according to the time of loading possible; and second-class steams are about 50s. per ton. Steam smalls are not quite so plentiful, and are steady at 28s. to 35s. per ton. These are, of course, the quotations for export to neutral countries. A little more coal is now being arranged for shipment to France at the "regulation" prices. The output is fair, and is well sold; but the want of transport facilities impedes early business. In the gas coal trade, the demand is fair; but the need of ready coasting steamers is felt. Best Durham gas coals are 37s. 6d. per ton f.o.b.; second-class gas coals are 35s. per ton; and "Wear Specials" are steady at 37s. 6d. to 38s. 6d. per ton f.o.b. As showing how enlistment is lessening production, it may be said that the large firm of Pease and Partners has officially stated that the output of coals at their Durham collieries was for the year ending April last 1,997,404 tons, which is 176,237 tons less than in the year ending April, 1914; and this is an example of many in Durham. Freights on gas coals are steady, owing to the scarcity of vessels, but fuller arrivals are anticipated. About 12s. is near the rate for coal, Tyne to the Thames. Coke is firm, with heavier exports. Good gas coke is quoted from 29s. to 31s. per ton f.o.b. As an indication of the rates paid for freight of coke, it may be said that, on Friday, three steamers were chartered at 42s. 6d., Tyne to Dunkirk—a high figure to add to the price of coke.

Montreal Light and Power Undertakings.—What is stated to be the most important power consolidation carried out in Canada has been effected in Montreal, by the organization of the Civic Investment Industrial Company, with an authorized capital of $75,000,000 (£15,000,000), to take over the Montreal Light, Heat, and Power Company and the Cedars Rapids Manufacturing and Power Company, and to operate them under an agreement for a period of 98 years. The Montreal Light, Heat, and Power Company was formed in 1901, and has acquired the whole of the capital stock of the Royal Electric Company, the Montreal and St. Lawrence Light and Power Company, the Imperial Electric Light Company, and practically the whole of the shares of the Montreal Gas Company; while in 1903-4 four other Companies were absorbed. These combined now supply all the gas and electricity (except one or two small plants) used in the City of Montreal and surrounding suburbs.

Great Yarmouth Water Company.—It is stated in the report of the Company for the year ended March 25, that an interim dividend at the rate of 4 per cent. per annum was paid in January last on the ordinary and additional ordinary stock for the half year to Sept. 29. The Directors anticipated that a final dividend could have been paid on this stock at the same rate; but they regret to state that, owing to the continued falling-off in revenue, due to the entire cessation of the visiting season and the herring fishing industry, the receipts for the year show a loss of more than £2300, and over £3800 since the beginning of the war. The balance of £9128 on profit and loss account is not available as ready money, as it has been utilized in the Company's business; and money market conditions have prevented the Directors from raising further capital to replace the balance. Owing to the unforeseen and alarming events with which the public are already familiar, and the consequent loss of trade, the Directors do not feel they would be justified in recommending any further dividend for the year.

Widnes Town Council and High Explosives.—An amendment which will probably cause some surprise was carried by ten votes to five at the monthly meeting of the Widnes Town Council last Tuesday. It had reference to two recommendations submitted by the Gas and Water Committee. Mr. Isaac Carr (the Engineer) had reported that the Ministry of Munitions were urging gas undertakings to further increase the production of toluol and benzol. The suggestion was that the light-giving hydrocarbons should be extracted. This would probably result in a reduction of illuminating power of 50 per cent.; while the calorific value would be reduced 15 per cent. The second proposal was the erection of a tar-distilling plant. The total cost of the two proposals would be £5500. Alderman Neil moved that the recommendations be not agreed to, and said the reduction in the quality of the gas for lighting purposes meant a serious matter for the Corporation. With regard to the second proposal, the time was inopportune. Mr. Davis said he failed to see the urgency of this matter now, seeing the request of the Minister of Munitions was made in the early part of last year. After discussion, the amendment was carried as stated.

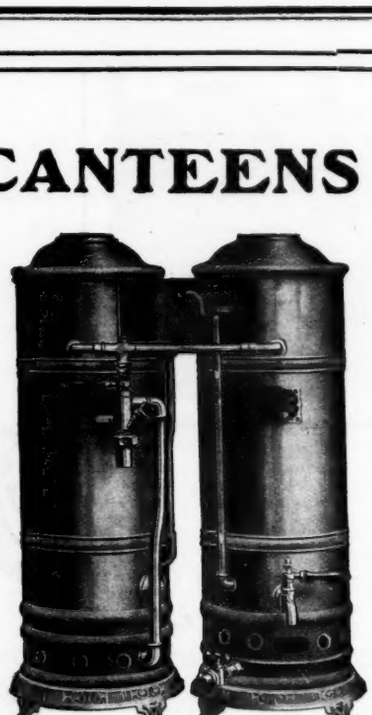
BOILING WATER IN CANTEENS

quickly supplied in any quantity by

Parkinson's Duo-Boiler

Boiling Water within 5 minutes of lighting the Gas and 40 gallons ready for use within half-an-hour.

Boilers on this principle have been supplied to the London County Council for many years past.
Illustration shows our latest improved type.



(Also without Reserve Container.)

Suitable for Factories, Restaurants, School-rooms or any situation where a large quantity of Boiling Water is required in a short time.

The Parkinson Stove Co., Ltd. (Water Heater Section),
STECHFORD, BIRMINGHAM.
London Show-Room: 129, High Holborn, W.C.

The Year's Working at Wantage.

In explaining the annual balance-sheet of the gas undertaking to the members of the Wantage Urban District Council, Mr. A. J. Belcher (the Chairman of the Gas Committee) said the Committee ventured to hope the Council would consider it satisfactory, under the circumstances. The year had been an exceedingly difficult one for all gas undertakings. Coal had increased by 20 per cent. on last year and 30 per cent. on five years previous. Pipe, brass fittings, &c., and glass were all up 100 per cent. Taking the expenditure side of the revenue account, coal had cost £2192, against £1901. Wages at the works had increased from £211 to £353. There was an increase under the heading of repairs and maintenance of works and plant amounting to £129. This was mainly due to the new retorts fixed last year; and to the new washer, pump, and accessories erected to meet the requirements of the War Office. On the income side, there was an increase of £250 by the sale of gas; public lighting was down by £32, owing to the restricted lighting; meter and stove rents were slightly up; and residual products showed an increase. The amount carried to profit and loss account was £357, which represented the gross profit for the year (out of which £50 had been contributed towards the rates). There was rather a larger profit than was anticipated, in view of the fact that the price of gas had been kept at 4s. per 1000 cubic feet, although the Council authorized the Committee to charge 4s. 2d. The amount of gas made was 15,311,000 cubic feet, against 14,842,000 last year. The quantity of coal carbonized was 50 tons less; and taking into account the extra gas made, the saving was equal to 103 tons. It was hoped that further economies would be effected in this direction. Unfortunately, the expenditure for the current year would continue to increase. Coal would cost £190 more; and wages would cost another £20. This had compelled the Committee to consider further the raising of the price of gas and coke; but they had decided to wait till later on in the year before recommending the Council to do it.

Triple Gas Fatality at Tunstall.—An inquest was opened last Wednesday (and then adjourned) on the bodies of three children who were found dead in bed at Tunstall on the previous Monday. The mother was unconscious, but recovered. It was stated by the Coroner that above the bed was a gas-bracket, "which had come off in some way or other." The father of the children is serving with the Colours.

Price of Gas at Hindley.—The Chairman of the Gas Committee (Mr. J. Stott), addressing the members of the Hindley Urban District Council, said the public were no doubt aware that the Committee were compelled to advance the price of gas; and it was agreed by the Finance Committee that they advance it 5d. per 1000 cubic feet, so as to meet all requirements. They put on 5d. last year, but had found it was not sufficient. There was the enhanced price of coal, and the rising price of labour, and other working expenses. The increase in the cost of coal alone amounted to £1212. There was a reduction in the sale of gas of £675. The total loss over last year was £1695; allowances for soldiers being included in this. They thought that the addition of 5d. per 1000 cubic feet would see them safely through. Daylight saving meant, with works like theirs, a difference of 150,000 cubic feet of gas per week, and it would also greatly increase their maintenance charges.

Fatal Tampering with a Meter.—Five deaths were caused in Birmingham last Sunday week, through the removal of the waste-water screw of a gas-meter. The victims were the wife of a soldier serving with the Colours and her four children, whose dead bodies were found by neighbours on forcing an entry into the house. At the inquest, Mr. Herbert Hodges, Superintendent of the Corporation meter inspection department, said the meter was last examined on May 11. No defect in it had been reported. With the waste-water screw off, the passage of gas through the aperture would be at the rate of between 50 and 60 cubic feet an hour. Witness added that he had never known an occurrence of this kind during his 37 years' experience. The Coroner, in summing up, remarked that there was no evidence to show how the screw was removed from the meter; but it was significant that one of the victims was mentally defective. The Jury returned a verdict of "Accidental death."

Mayoral Visit to the Birmingham Gas-Works.—On Monday morning of last week, the Lord Mayor of Birmingham (Alderman Neville Chamberlain) visited the manufacturing stations of the Corporation Gas Department. It is stated that there was no special object in the visit, except that of personal interest. Accompanied by Alderman Sir Hallewell Rogers (the Chairman of the Gas Committee), the Lord Mayor first drove to the Saltley works, where he was met by Mr. W. Chaney (the Engineer) and Captain R. S. Hilton (the Secretary to the Gas Committee). Shown round the establishment, he was particularly impressed by the Koppers coke-ovens and the Mond gas plant in operation. From there he went to the Nechells works, where Mr. G. B. Tomlinson (the Engineer) and Mr. E. W. Smith (the Chief Chemist) conducted him through the various departments; and he saw the test plant at work, the apparatus for the manufacture of toluol, and new retorts which are in process of erection.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.

ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD.,
Exeter, London, Manchester, Leicester.

Telegrams:
"WILLEY, EXETER."
"GASVILLADO, KINLAND, LONDON."
"METERS, LEICESTER."
"WILMETER, MANCHESTER."

Telephone Nos.:
192 EXETER.
224 DALSTON, LONDON.
4777 LEICESTER.
7419 CITY (MANCHESTER).

LONDON WORKS & OFFICES:
91-95, Hertford Road, Kingsland, N.
LEICESTER:
5, Oxendon Street.
MANCHESTER:
50, John Street, Chorlton-on-Medlock.
AGENTS FOR SCOTLAND:
D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

Following a private session of the triennial congress of the National Union of Gas Workers and General Labourers, it was stated that the title of the Society had been changed to that of the National Union of General Workers. The reason for the change is that the Union, from being a small body of gas workers, had developed into an organization including all classes of skilled and semi-skilled workers.

Radiation and optical pyrometers are dealt with in a new list issued by the Cambridge Scientific Instrument Company, Limited. The advantages of three main types of pyrometers suitable for the measurement of very high temperatures, form an indication to the reader as to whether his requirements are likely to be best met by the Féry radiation pyrometer (thermo-electric), the Féry radiation pyrometer (spiral), or the Cambridge optical pyrometer. It is pointed out that the choice of a pyrometer for the higher temperatures depends largely upon the conditions of working; and each case should be considered separately. For the measurement of lower temperatures, instruments of other types are provided; and these are described in separate lists.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange was quite active last week, and markets in general continued to exhibit great strength. It is true one or two of them were "streaky" here and there, and not uniformly on the bound, owing to special factors; but the predominant tone was quite cheerful. Advices from every seat of war were favourable; and better weather gave greater promise for crops. Government issues started very strong; and on Tuesday War Loan was done at 97, and Consols at 61 11/16. These figures led to reaction next day. Then came recovery on Thursday; but on Friday the Government advance in Treasury Bill rates upset the market again. Home Rails had a uniformly good week; the demand steady and persistent. The Foreign Market also was in fine form. The French Loan reached 87½; and Russian, Japan, China, and Brazil issues were in steady request. Argentines effected an advance, and South Africans improved. The Miscellaneous Market did not figure so conspicuously. Rubber shares had rather a dull fit. Shipping concerns receded before realizations to secure profits on recent rises, and were afterwards rather irregular, and textiles showed variations. Oil was about as steady as anything. Business in the Gas Market was very quiet indeed all throughout the list; the premier issue itself counting only seven bargains. But so far from weakening, the prices realized were rather higher than the week before. The other Metropolitan Companies were quite firm. Suburban and Provincial undertakings showed nothing remarkable. In the Continental, Imperial was slightly easier. The Directors of the Continental Union announce that circumstances compel them to pass the preference and ordinary interim dividends. In the Money Market, the rise in rates named above was the feature. Among general topics, Dollar Securities are still pouring in millions into the Treasury, and the proceeds have to be invested somewhere. The Nigerian Loan did not attract much of it, and was quite a frost.

Bargains done for cash during the week were as follows: On Monday, British debenture 70, Commercial 4 per cent. 73¾, 74¼, Continental Union 36¾, Gas Light ordinary 75¾, ditto preference 74½, 75, 75⅛, 75¾, South Metropolitan debenture 60¼. On Tuesday, British 35, 35⅛, Gas Light ordinary 76⅜, 76¾, ditto maximum 63, Imperial Continental 76, Primitiva 40, ditto preference 3¼, South Metropolitan 80½. On Wednesday, Commercial debenture 56, Imperial Continental debenture 64, 64½, South Metropolitan 80½, 80⅝, 81¼, Wimbledon 90. On Thursday, Gas Light ordinary 76¼, 77, ditto preference 75¼, 76, ditto debenture 59, 59½, 60⅜, Primitiva preference 3 5/16, San Paulo preference 8 9/16, Wimbledon 90½. On Friday, Gas Light ordinary 76½, ditto maximum 60½, Imperial Continental 75, 76, Primitiva 39s. 6d., South Metropolitan, 80⅜, 81½. On Saturday, Gas Light ordinary 76¼, ditto preference, 75⅛ 76, Imperial Continental 75, Primitiva 38s. 9d., 39s., 40s., ditto preference 3 5/16. A bargain in Liverpool at 87⅝ and another in Sheffield "C" at 180 were done locally in the previous week, but holiday interruptions to postal deliveries delayed reception of advices.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When last Dividend.	Previous Div on Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.		
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	..
980,000	5	April 29	7½	8/-	Bombay, Ltd.	5⅞—6⅜	6 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { B ¶ p.c.	29—30	5 6 8	..
333,110	10	,,	7	7/-	Pref. 6 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	4 p.c. Deb.	13¾—14	4 5 9	..
159,740	—	—	—	4	Brentford A Consold.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Do. B New	261—266	5 5 8	..
734,920	,,	,,	†11	55/-	Do. 5 p.c. Pref.	204—209	5 6 8	..
55,000	,,	,,	5	5	Do. 4 p.c. Deb.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Brighton & Hove Orig.	91—93	4 6 0	..
217,880	Stk.	Feb. 26	11	10⅜	Do. A Ord. Stk.	208—213	5 8 4	..
244,200	,,	,,	8	7⅜	British	154—159	5 0 8	..
580,000	20	Mar. 26	19½	22/6	Do. 4 p.c. Deb. Stk.	44—45	5 11 1	85—85½
190,000	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	88—90	4 8 11	70
245,771	Stk.	June 26	4	4	Cape Town & Dis., Ltd.	85—87	4 12 0	..
100,000	10	—	—	—	Do. 4½ p.c. Pref.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Deb. Stk.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Chester 5 p.c. Ord.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Commercial 4 p.c. Stk.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Do. 3½ p.c. do.	106—108	5 1 2	73½—74½
560,000	,,	,,	5¼	46/8	Do. 3 p.c. Deb. Stk.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Continental Union, Ltd.	69½—71½	4 8 11	56
800 000	Stk.	,,	4	—	Do. 7 p.c. Pref.	76—79	5 1 3	36½
200 000	,,	,,	7	—	Croydon B and C 7 p.c.	115—118	5 18 8	..
278,400	—	,,	—	11½	Derby Con. Stk.	..	—	..
493,270	Stk.	—	6	5½	Do. Deb. Stk.	128—125	4 16 0	..
55,000	,,	—	4	4	European, Ltd.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	Gas Light and Coke { 4 p.c. Ord.	17½—18	5 11 1	..
16,827,185	Stk.	Feb. 10	4/17/4	42/-	4 p.c. Con. Pref.	98—102	4 15 6	75½—77
2,600,000	,,	,,	3½	3½	8½ p.c. max.	76—79	4 8 7	60—60½
4,062,285	,,	,,	4	4	8 p.c. Con. Deb.	96—99	4 0 10	74½—76
4,674,850	,,	June 11	3	3	10 p.c. Bonds	72½—74½	4 0 6	59—60½
130,000	,,	,,	10	10	Hastings & St. L. 3½ p.c.	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hongkong & China, Ltd.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hornsey 7 p.c.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Ilford A and C	..	—	..
131,000	Stk.	Mar. 12	7¼	7½	Do. B	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. 4 p.c. Deb.	115—118	5 8 0	..
65,500	,,	June 26	4	4	Imperial Continental	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Do. 3½ p.c. Deb. Red.	150—160	5 12 6	75—76
1,235,000	Stk.	Feb. 12	3½	3½	Lea Bridge Ord. 5 p.c.	84—86	4 1 5	64—64½
235,242	Stk.	Mar. 12	6½	6½	Liverpool 5 p.c. Ord. { A	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	B	211—218	4 18 11	} ..
806,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	146—148	4 14 7	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	..	—	..
250,000	100	April 1	4½	4½	Met. of Melbourne { 4½ p.c. Deb.	4½—4⅝	6 9 9	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	99—101	4 9 1	..
1,875,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	11½—12	6 18 4	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	98½—99½	4 10 6	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	85—88	4 4 10	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	14—15	5 2 8	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	117—122	6 17 2	..
60,000	50	Feb. 26	18	65/-	Portsea, Island B	7⅜—7¾	6 9 0	..
100,000	50	,,	12	60/-	Do. C	198—131	4 19 3	..
52,000	50	,,	10	—	Do. D	118—121	4 19 2	..
249,980	5	April 29	8	—	Primitiva Ord.	..	—	..
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	5½—6	5 18 4	1⅛—2
521,600	100	June 2	4	4	,, 4 p.c. Deb.	4½—5	5 0 0	3½—3 5/16
—	—	—	—	4	,, ,, ,, 1911	91—93	4 6 0	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	..	—	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	85—87	4 12 0	..
125,000	50	July 1	5	5	5 p.c. Deb.	10½—11	5 9 1	8 5/16
135,000	Stk.	Mar. 12	10	10	Sheffield A	47—49	5 2 0	..
209,984	,,	,,	10	10	Do. B	223—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	222—224	4 9 8	..
90,000	10	May 28	9	6/-	South African	220—222	4 10 1	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	10½—11½	7 16 6	..
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	111—113	4 16 8	80½—81½
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	72½—74½	4 0 6	60½
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	157—159	5 6 11	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	114—116	5 8 5	..
135,000	—	—	—	48/4	Do. West Kent.	110—112	4 9 8	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	..	—	..
647,740	Stk.	May 14	5	5	Southampton Ord.	116—118	4 4 9	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c.	99—102	4 18 0	..
782,275	,,	,,	6	6	B 3½ p.c.	135—138	5 6 8	..
181,255	,,	June 26	4	4	4 p.c. Deb.	115—117	5 2 7	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	87—89	4 9 11	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	5—6	8 6 8	..
286,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	93—95	5 5 3	..
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	103½—109½	4 11 4	..
255,636	,,	,,	6⅜	63/9	,, B 3½ p.c.	151—156	5 7 4	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	129—134	5 2 7	..
352,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	110—115	5 2 0	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	117—122	5 0 5	90—90½
88,416	,,	June 26	3	3	5 p.c. Deb. Stk.	121—126	5 5 2	..
						66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS ENGINEER. Birkenhead Corporation. Applications by July 7.
CLERK. Weymouth Water Company.
RENTAL CLERK. Gas Company, Sheerness.
BLACKSMITH AND WORKS FITTER. No. 6188.

Plant &c. (Second Hand), for Sale.

WET METER. No. 6190.

TENDERS FOR

Briquetting Plant.

DARLINGTON GAS DEPARTMENT. Tenders by July 3.

Coal.

HAWORTH DISTRICT COUNCIL. Tenders by June 24.
MORECAMBE GAS DEPARTMENT. Tenders by July 1.
STRATFORD-ON-AVON GAS DEPARTMENT. Tenders by June 28.

Gas Booster.

MALVERN GAS DEPARTMENT. Tenders by June 27.

Tar and Liquor.

WORKSOP GAS COMPANY. Tenders by June 26. No. 6189.

H. MITCHELL, FOR PATENT SLOT METER PAD & OTHER LOCKS. 3 & 5, LEIGHTON ROAD, KENTISH TOWN, N.W. R. & J. DEMPSTER, LTD., 54 & 2296 Manchester.